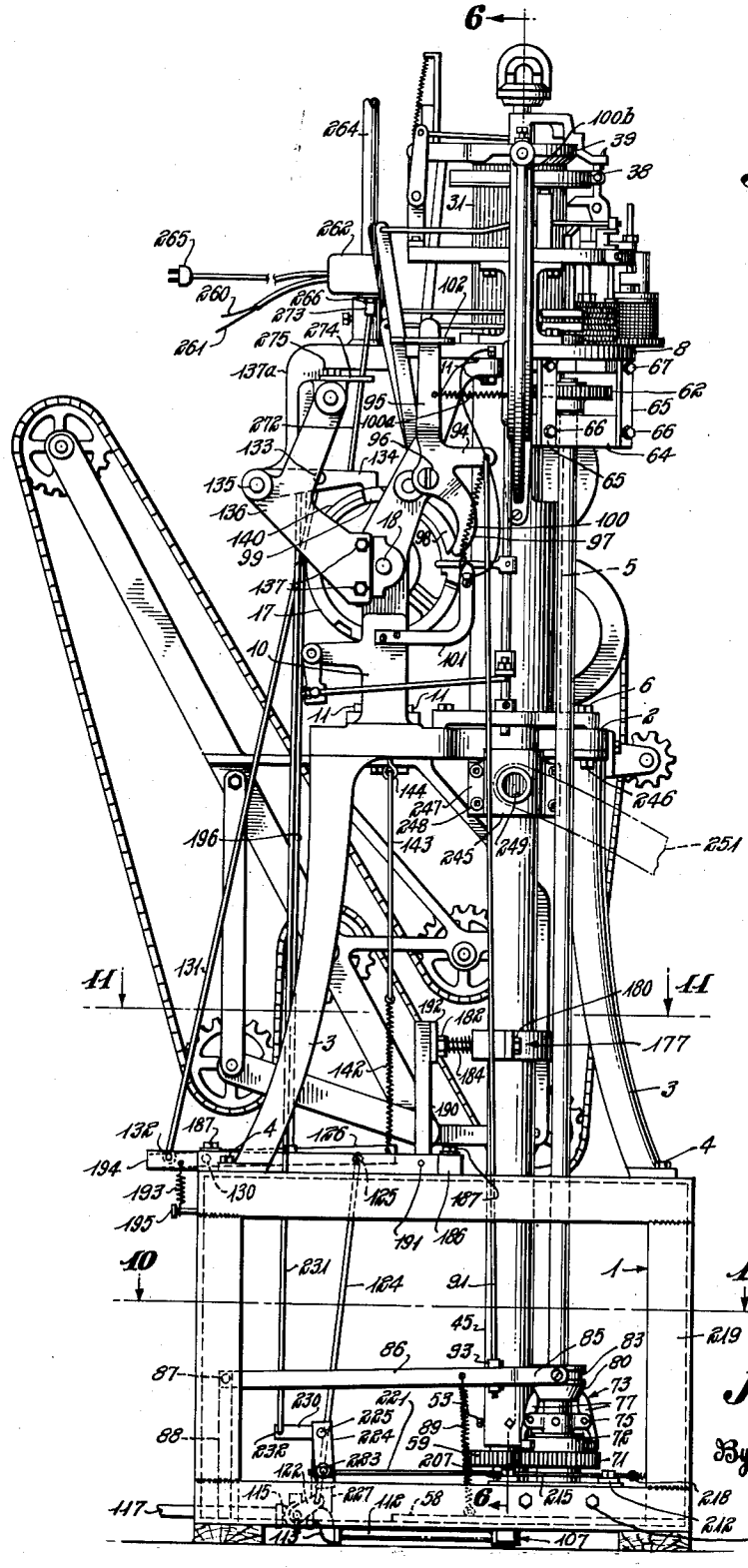
Jan. 3, 1956 J. F. TEW 2,729,082

AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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Fig. 1.



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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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Fig. 3.

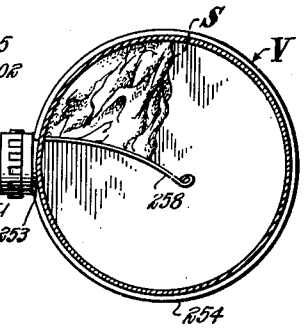


Fig. 2.

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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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Fig. 4.

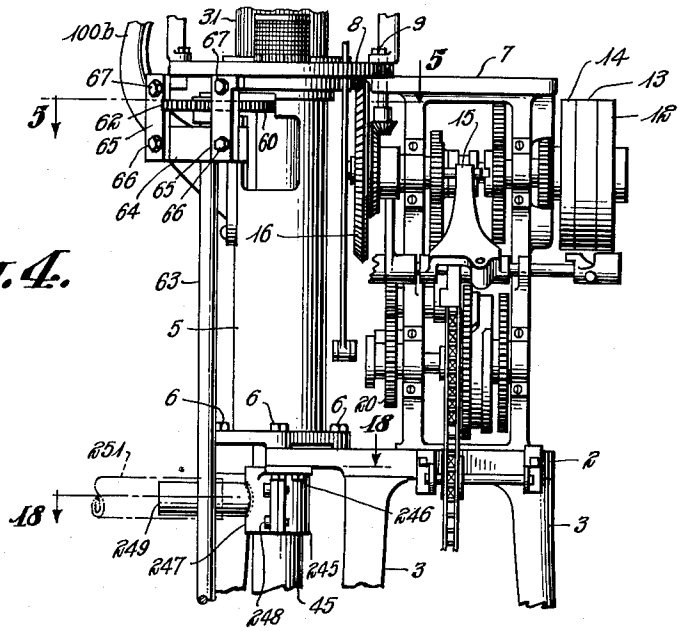
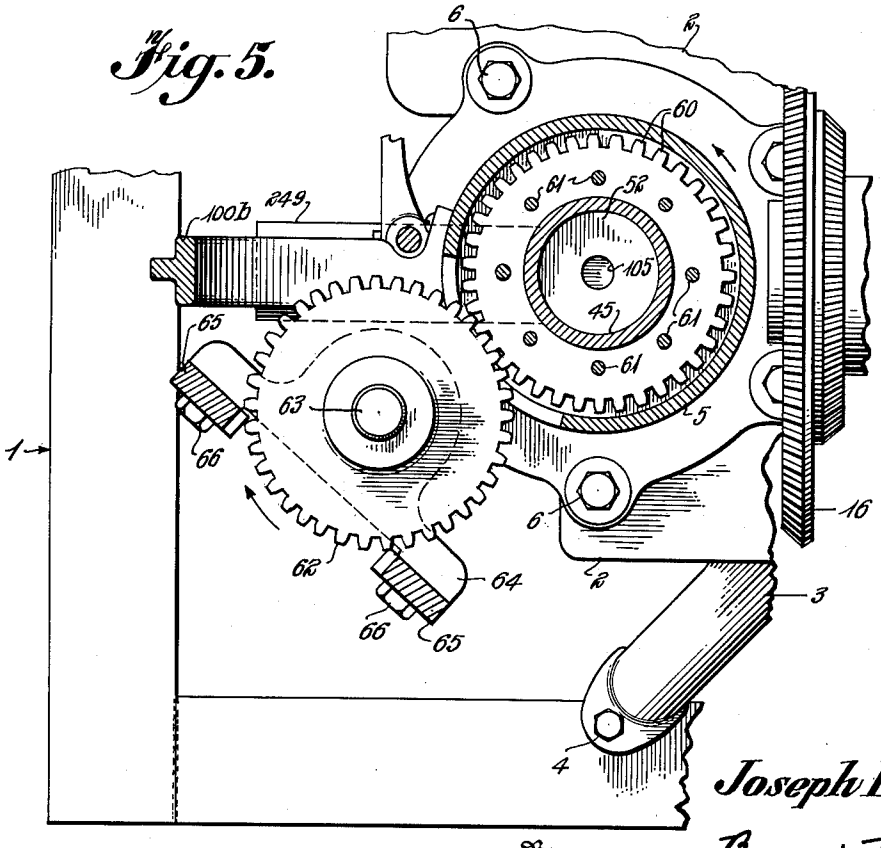


Fig. 5.



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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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Fig. 6.

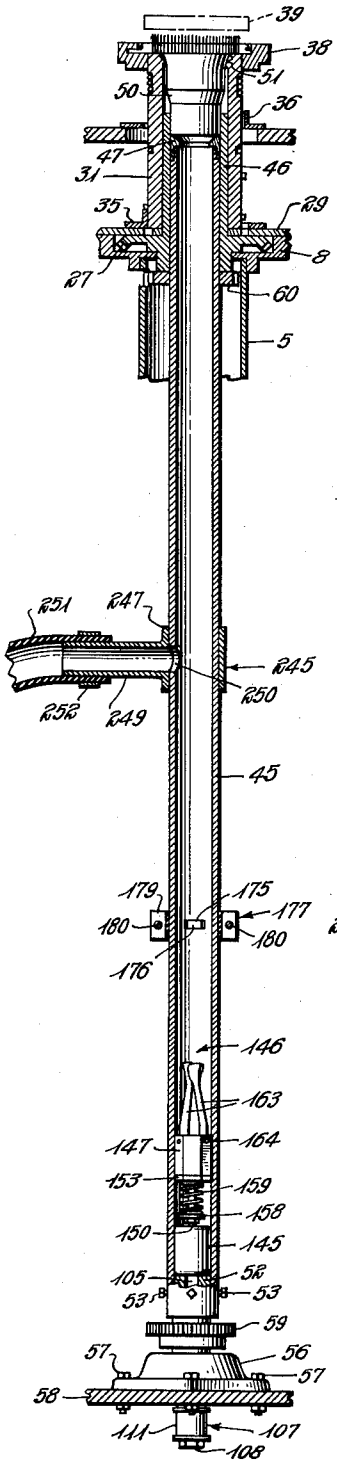


Fig. 29.

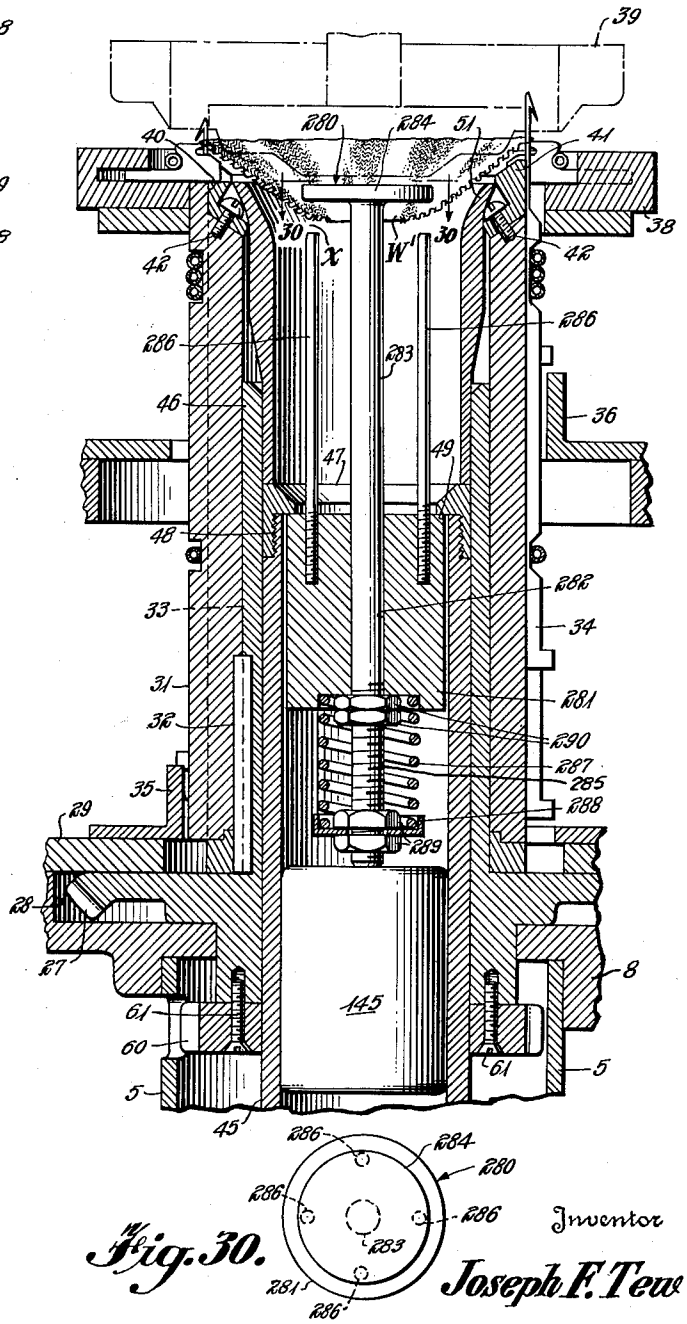


Fig. 30.

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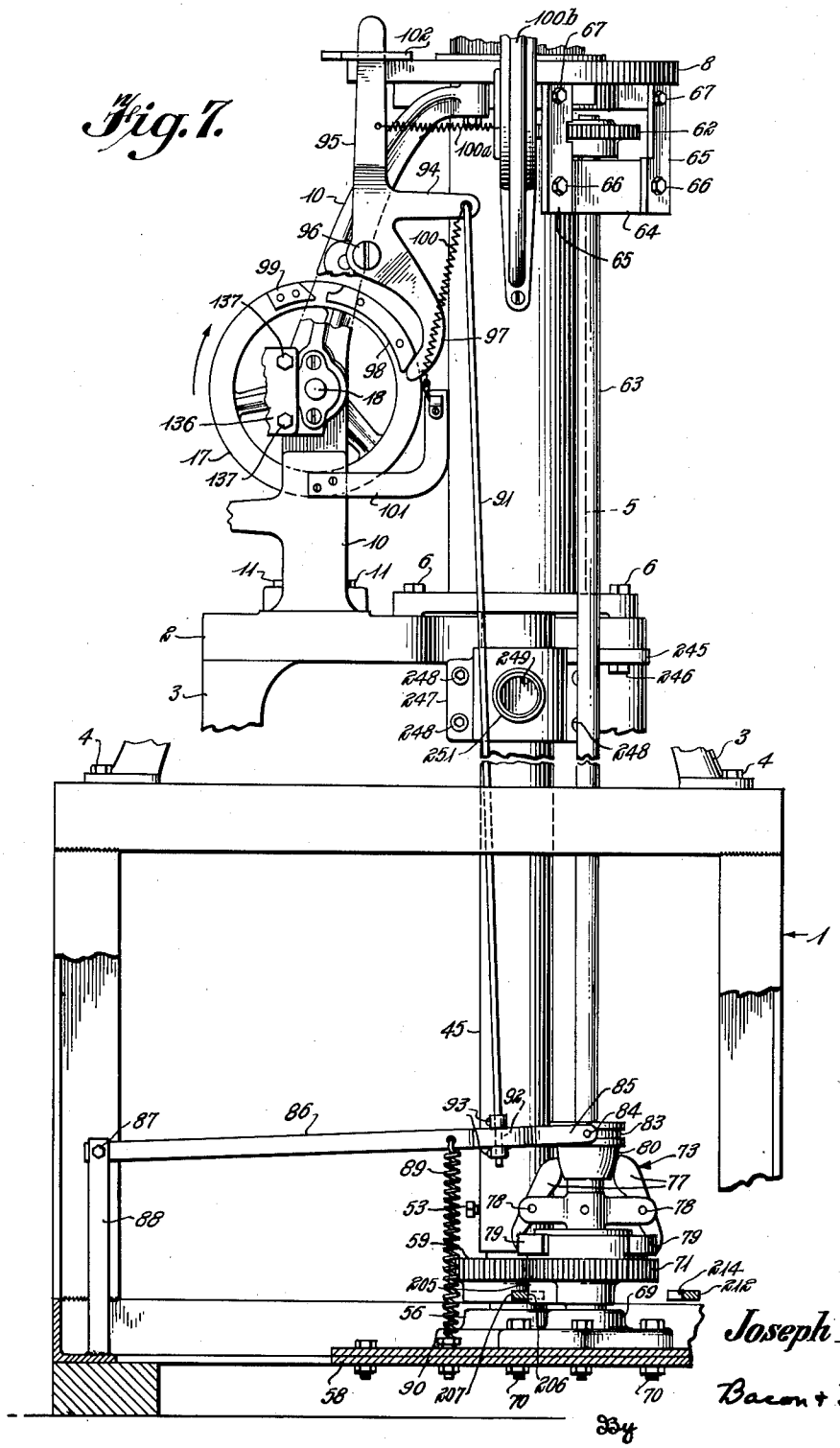
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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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Fig. 7.



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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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Fig. 9.

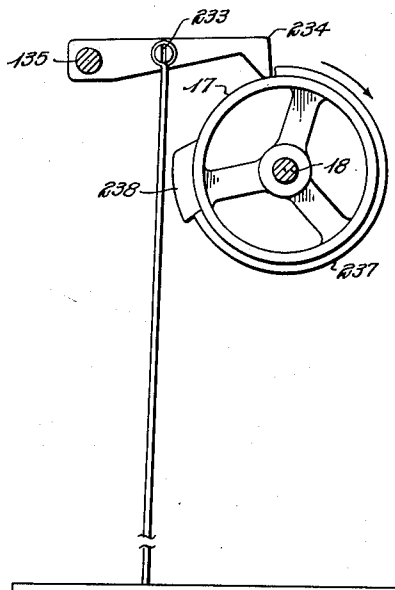
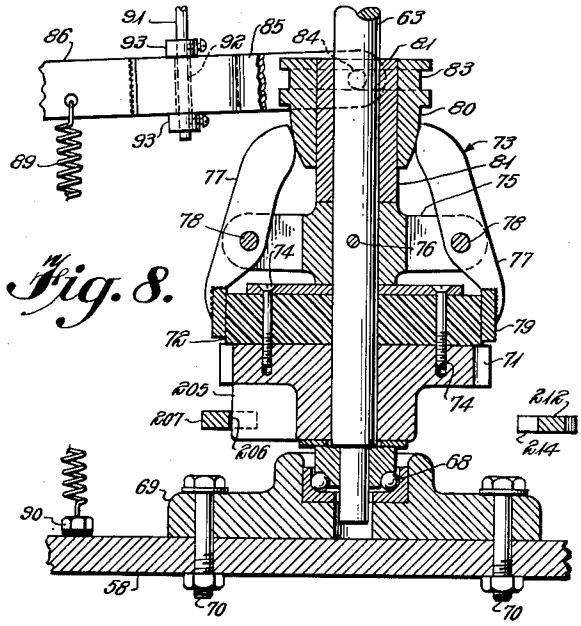
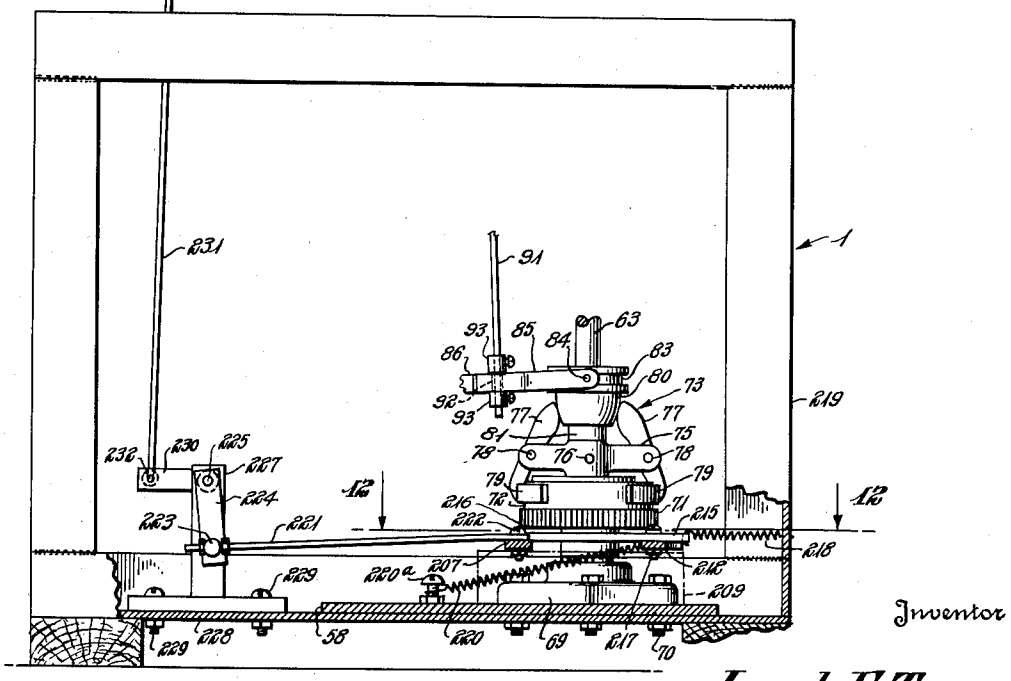


Fig. 8.





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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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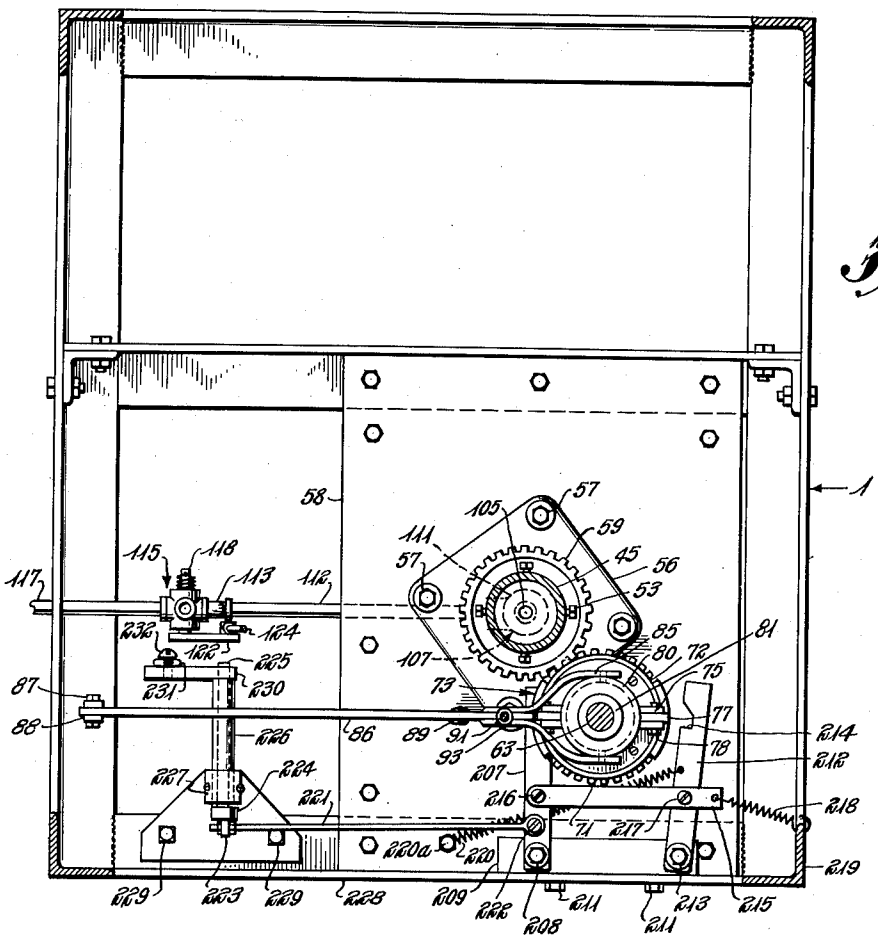


Fig. 10.

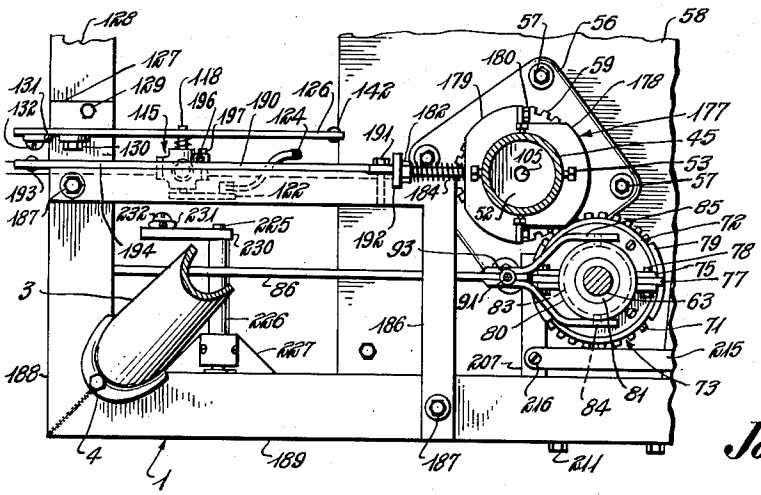


Fig. 11.

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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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Fig. 13.

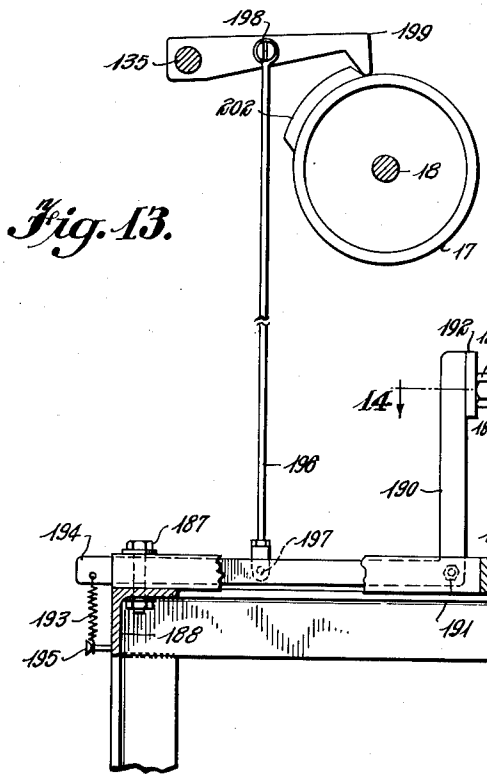


Fig. 14.

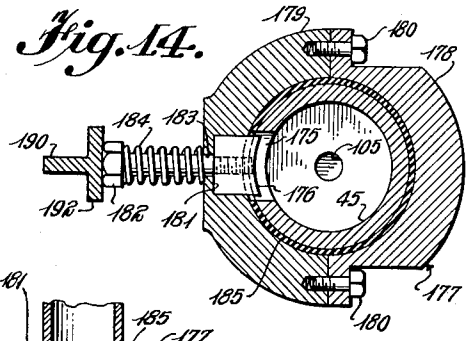
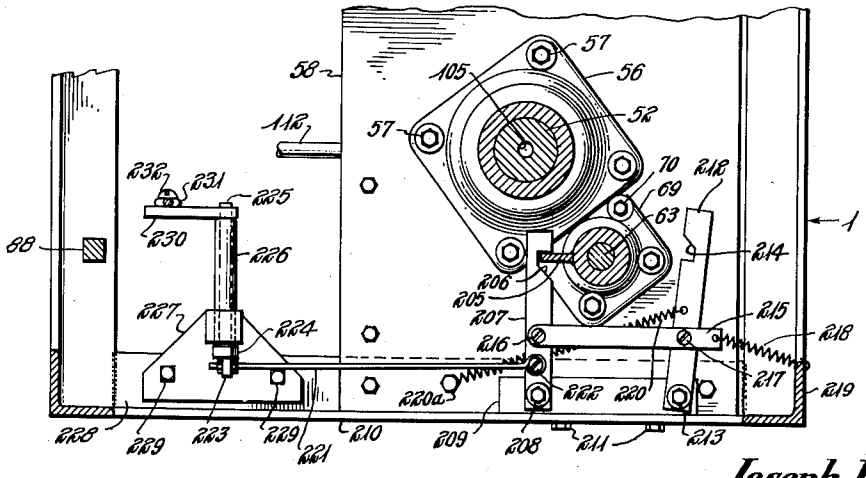


Fig. 12.



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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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Fig. 15.

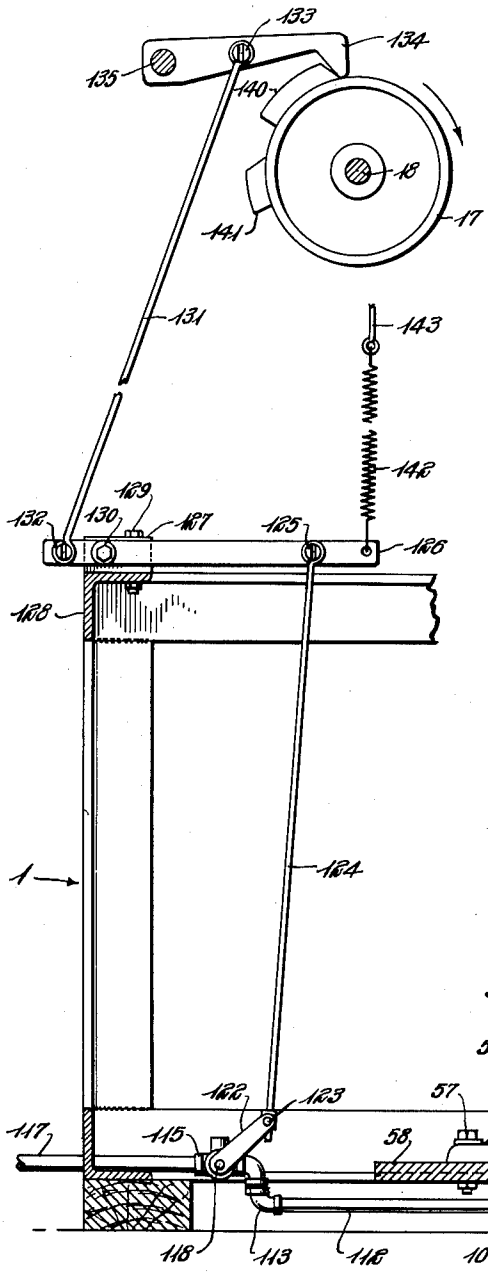


Fig. 17.

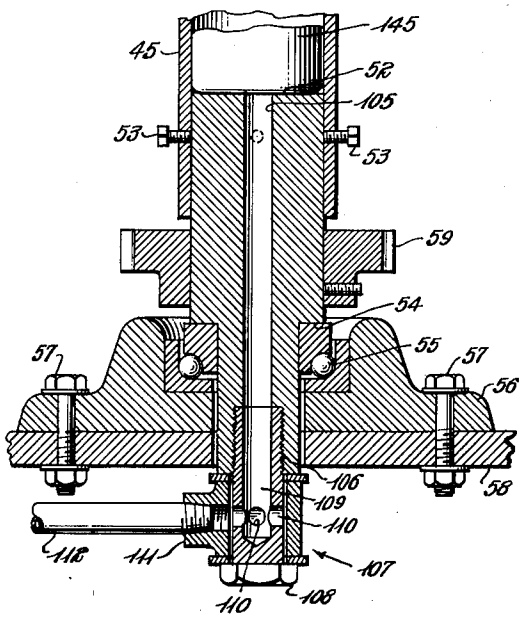
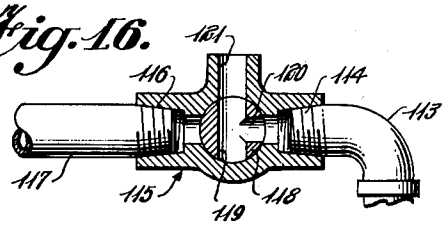


Fig. 16.



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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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Fig. 20.

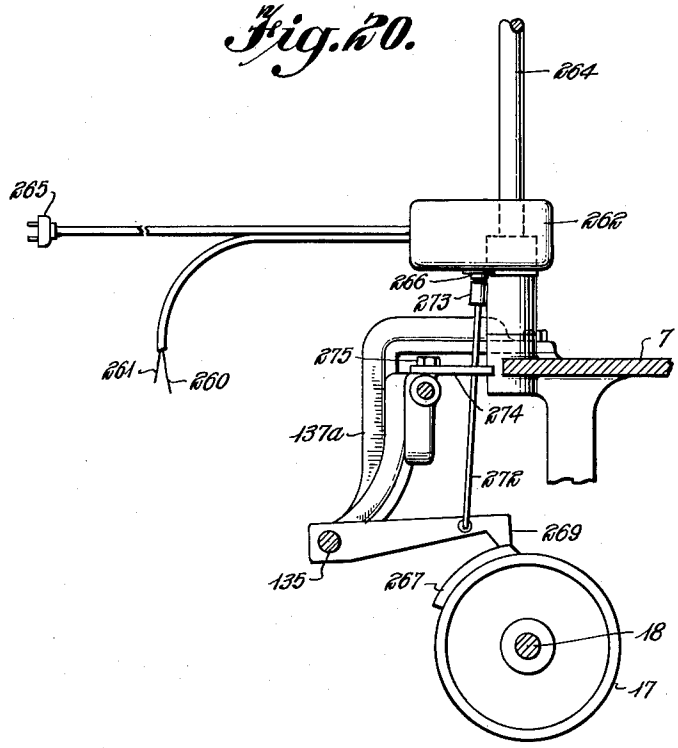


Fig. 18.

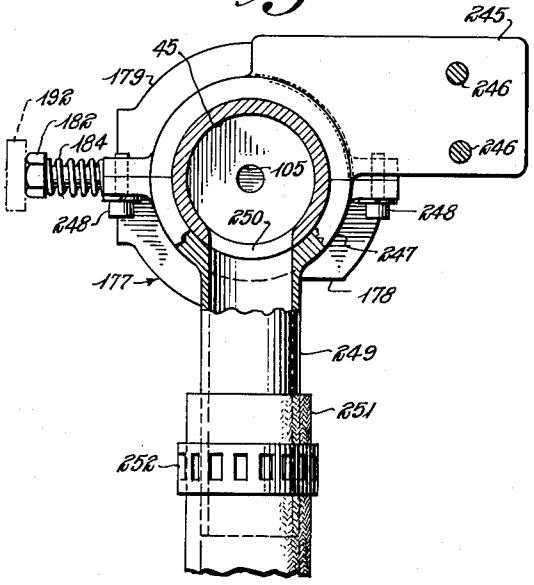
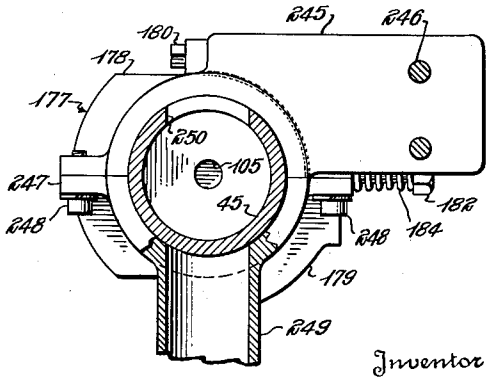


Fig. 19.



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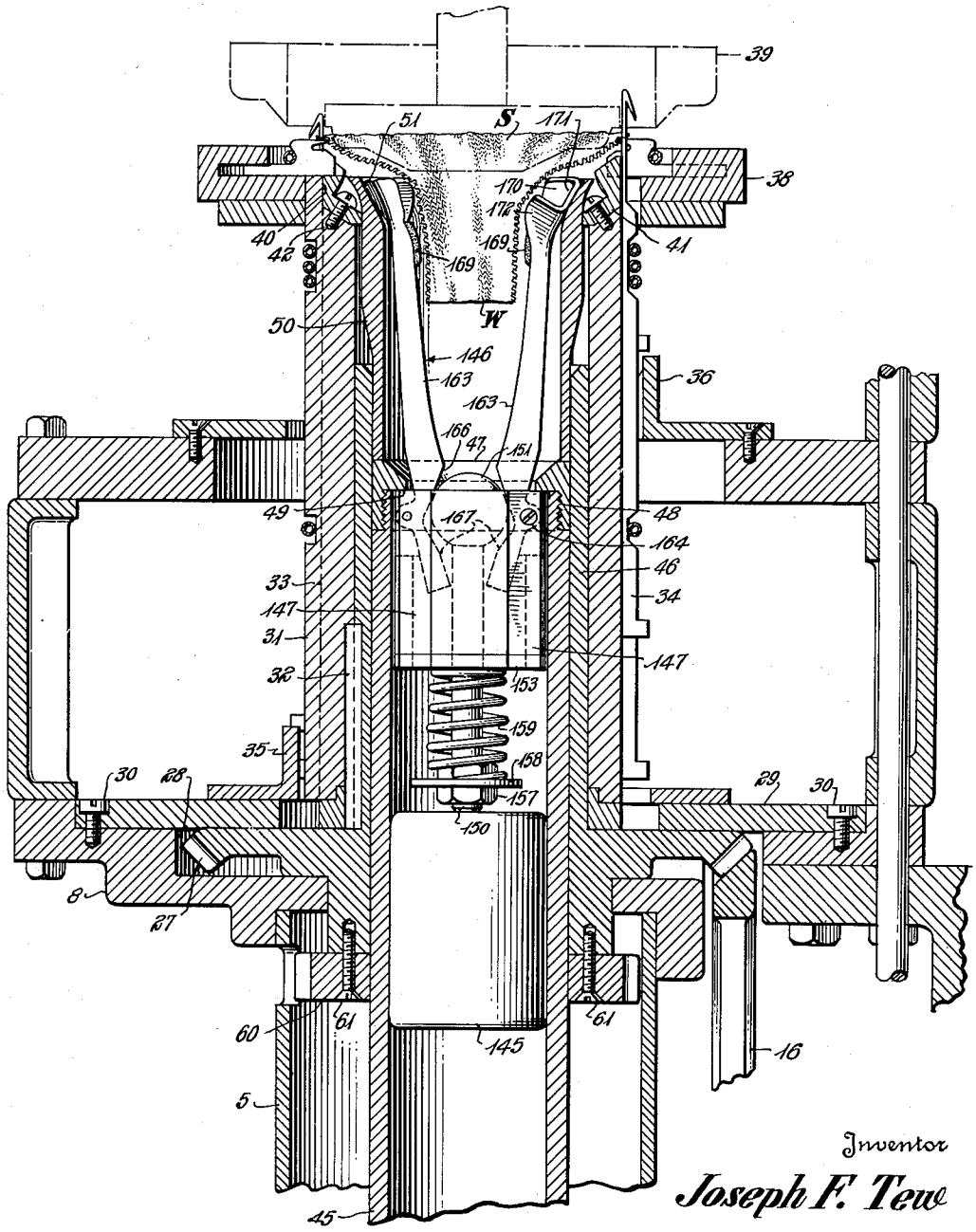
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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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Fig. 21.



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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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Fig. 22.

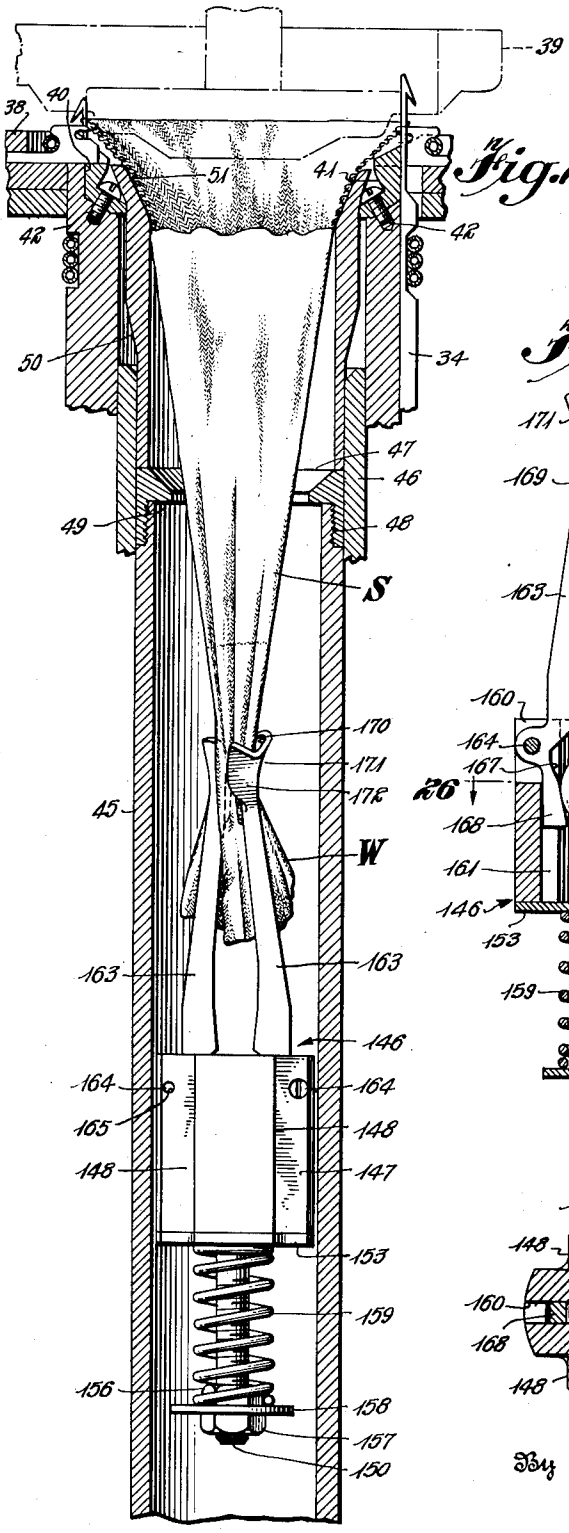


Fig. 23.

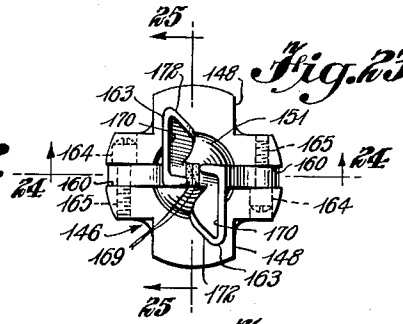


Fig. 24.

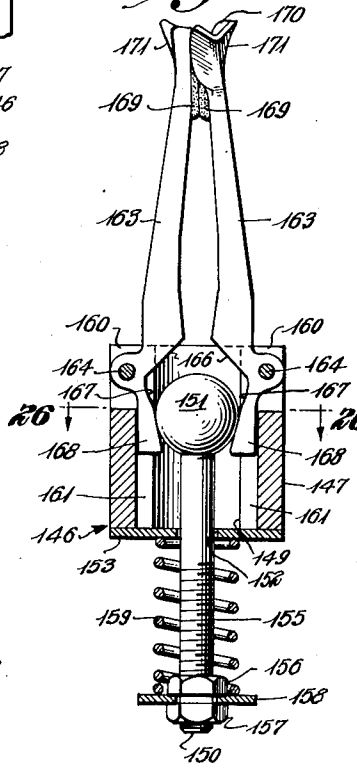


Fig. 25.

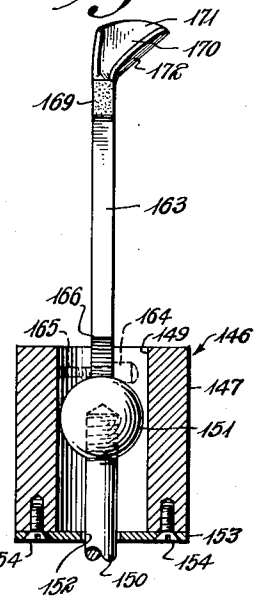
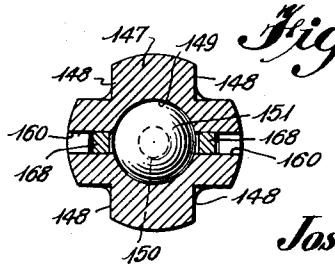


Fig. 26.



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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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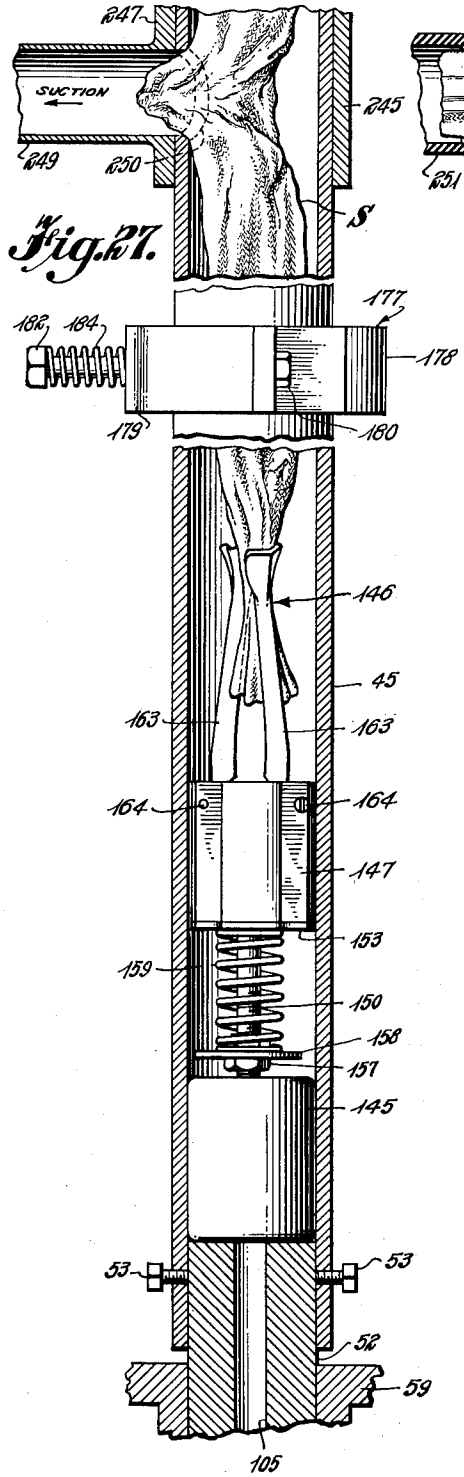


Fig. 27.

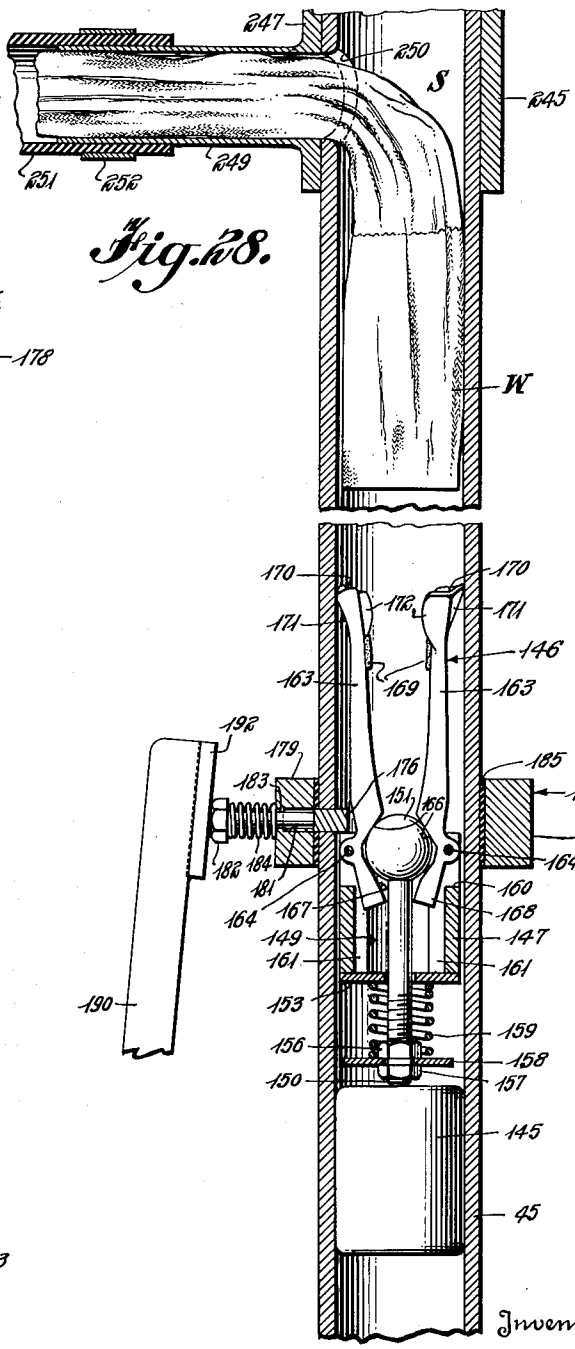


Fig. 28.

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AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

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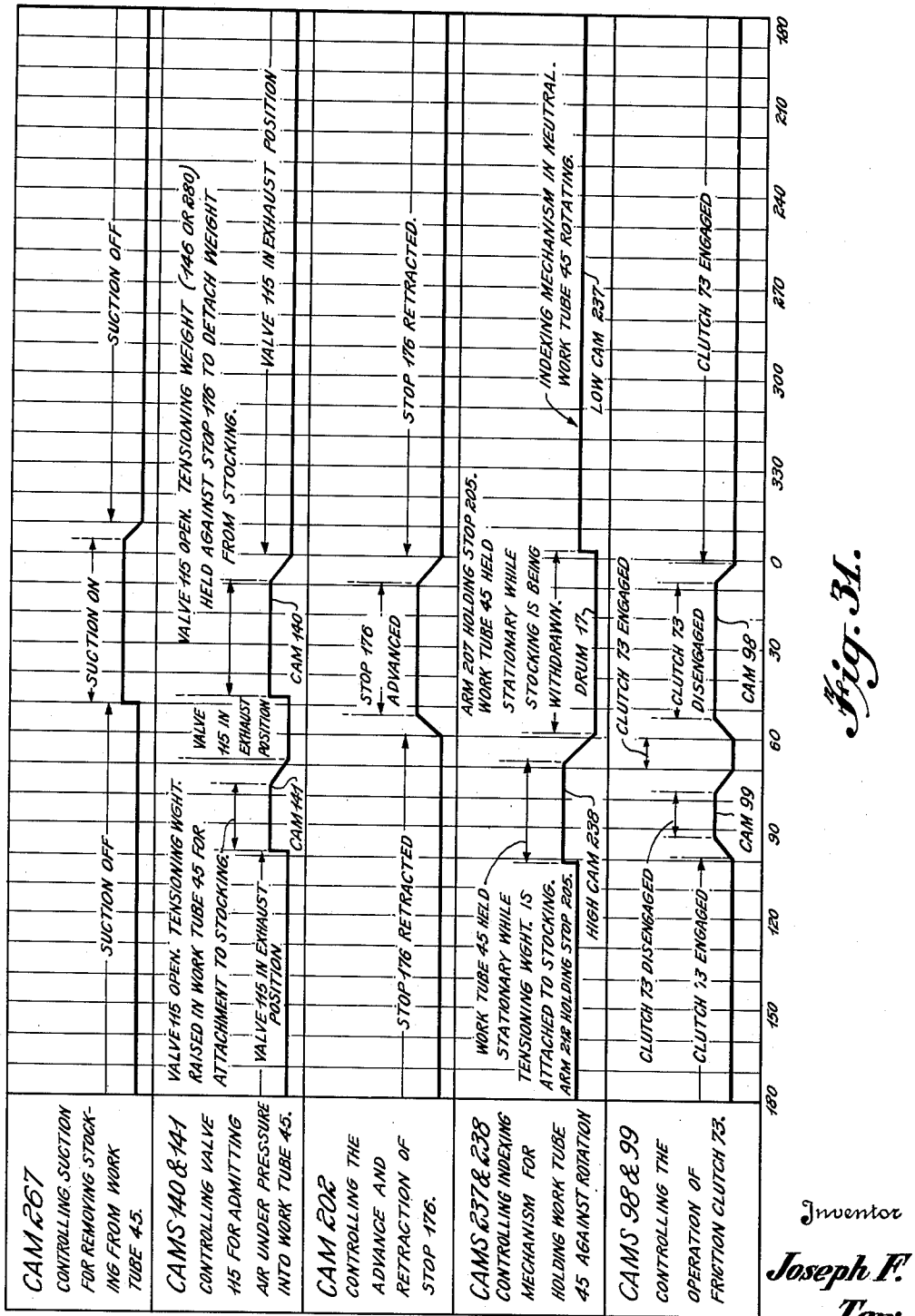


Fig. 31.

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United States Patent Office 2,729,082 Patented Jan. 3, 1956

2,729,082

AUTOMATIC TAKE-UP MEANS FOR KNITTING MACHINES

Joseph F. Tew, Newland, N. C., assignor, by mesne assignments, to Scott & Williams, Incorporated, Laconia, N. H., a corporation of Massachusetts

Application April 13, 1951, Serial No. 220,822

21 Claims. (Cl. 66—149)

The present invention relates to improvements generally useful in knitting machines, and more particularly to mechanism for automatically applying a take-up device or tensioning weight to fabric during knitting and for automatically detaching said device from the fabric article after knitting has been completed.

More specifically, the invention relates to improvements useful in circular hosiery knitting machines, and to mechanism for automatically applying a take-up to the stocking fabric, preferably as soon as sufficient fabric has been knitted to attach a tensioning weight thereto, and for automatically detaching the take-up from the stocking after knitting of the stocking has been completed. The structure embodied in the present invention for accomplishing the foregoing includes a specially designed take-up device reciprocable in a work tube and having spring pressed fingers adapted to be opened or spread apart by a pneumatically operated piston in the work tube; an abutment being provided at the upper end of the work tube for holding the take-up device while the piston spreads the fingers apart temporarily to receive the knitted fabric therebetween; and a stop member located at an intermediate region of the work tube and projectable into the work tube to serve as another abutment for engagement by the take-up device for holding said take-up device while said piston again effects opening of the fingers thereof to release the stocking therefrom after knitting of the stocking has been completed.

The invention further relates to automatic means for removing the completed stocking from the work tube after the tensioning or take-up device has been detached therefrom. A suction device having a storage receptacle associated therewith has been found to be satisfactory for this purpose.

It is the current practice in many hosiery mills to manually apply a weight to a stocking while it is being knitted to tension the same and to manually detach the weight from the stocking after the completed stocking has dropped from the machine on to the floor or into a receptacle below the work discharge tube. This practice is objectionable for various reasons, and particularly in view of the fact that it requires the employment of unnecessary labor, which increases the cost of production, and requires attentive application of the weight at the proper time in order to insure a satisfactory product, which is not obtainable with careless help.

The principal object of the invention is to provide means for automatically tensioning circular knit fabric as soon as sufficient fabric has been knitted to suspend a take-up weight therefrom, to thereby produce fabric having uniform stitches.

Another object of the invention is to provide a take-up or tensioning device which will not damage the fabric in any way and which is adapted to have its mass varied in accordance with the character and weight of yarn employed in knitting a particular product.

Another object of the invention is to provide a take-up or tensioning device which will maintain itself suspended from the fabric being knitted and which will rotate with the fabric to avoid twisting or damage to the fabric.

A further object of the invention is to provide mechanism for automatically applying a tensioning weight or take-up device to a stocking during knitting, and for automatically detaching such tensioning weight or take-up device from the stocking after knitting has been completed.

A still further object of the invention is to provide means for automatically removing a completed stocking from the work tube after the tensioning weight has been detached from the stocking.

Still another object of the invention is to provide in combination with the stocking removing means, a storage receptacle in which the stockings can be temporarily stored to prevent the same from becoming damaged or soiled.

Still another object of the invention is to provide a tensioning device peculiarly adapted for attachment to elastic-top hose.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a left side elevational view of a circular hosiery knitting machine embodying the principle of the present invention;

Fig. 2 is a rear elevational view of the machine shown in Fig. 1, but illustrating in addition the suction device for effecting withdrawal of the completed stocking from the work tube of the machine;

Fig. 3 is a horizontal sectional view through the storage receptacle of the suction device taken on the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary front elevational view of the upper portion of the knitting machine and particularly illustrating the drive means thereof;

Fig. 5 is an enlarged horizontal sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a vertical sectional view through the work tube of the machine, taken on the lines 6—6 of Fig. 1;

Fig. 7 is a schematic view illustrating the friction clutch and drive mechanism for the work tube together with the cam and control means for controlling the operation of said clutch;

Fig. 8 is an enlarged vertical sectional view through the clutch mechanism shown in Fig. 7;

Fig. 9 is a schematic view illustrating the cams and control mechanism for locking the driven element of the friction clutch in predetermined indexed positions;

Fig. 10 is an enlarged horizontal sectional view taken on the line 10—10 of Fig. 1;

Fig. 11 is a similar sectional view taken on the line 11—11 of Fig. 1;

Fig. 12 is a horizontal sectional view particularly illustrating the indexing mechanism, taken on the line 12—12 of Fig. 9;

Fig. 13 is a schematic view illustrating a cam and control mechanism for controlling the operation of a stop member co-operable with the tensioning weight for effecting release of a stocking from said tensioning weight;

Fig. 14 is a horizontal sectional view taken on line 14—14 of Fig. 13;

Fig. 15 is a schematic view illustrating an air valve and an air valve control cam for controlling the operation of the piston which effects attachment to and detachment of the tensioning weight or take-up device from the knitted fabric;

Fig. 16 is a longitudinal sectional view through the air valve shown in Fig. 15;

Fig. 17 is an enlarged vertical sectional view through the lower end of the work tube showing the means by

which air under pressure is admitted into said work tube;

Fig. 18 is an enlarged sectional view taken on the line 18—18 of Fig. 4 and illustrating the position in which the work tube is indexed during detachment of the take-up weight from the stocking and during withdrawal of the completed stocking from said work tube;

Fig. 19 is a similar view, but illustrating the work tube in the position in which it is indexed during attachment of the tensioning weight to the end of a stocking;

Fig. 20 is a schematic view illustrating a cam and switch operated thereby for controlling the operation of the suction device for withdrawing the stocking from the work tube after the tensioning weight has been detached from the stocking;

Fig. 21 is an enlarged vertical sectional view taken through the needle cylinder and the upper end of the work tube and illustrating the tensioning weight or take-up device in its uppermost position with its fingers in open position to receive the knitted fabric therebetween;

Fig. 22 illustrates the tensioning weight suspended from the welt end of a stocking;

Fig. 23 is a plan view of the tensioning weight per se shown in Figs. 21 and 22;

Fig. 24 is a vertical sectional view taken on the line 24—24 of Fig. 23;

Fig. 25 is a similar view taken on the line 25—25 of Fig. 23;

Fig. 26 is a horizontal sectional view taken on the line 26—26 of Fig. 24;

Fig. 27 is a vertical sectional view through the work tube, illustrating the tensioning weight after having dropped to the lower end of the work tube upon completion of the knitting of a stocking;

Fig. 28 is a similar view through the work tube illustrating the tensioning weight held against a stop with its fingers spread apart, and the released stocking being withdrawn through the discharge opening of the work tube;

Fig. 29 is a vertical sectional view through the needle cylinder and work tube illustrating a different kind of tensioning weight particularly adapted for use with elastic-top hose;

Fig. 30 is a plan view of the modified tensioning weight taken on the line 30—30 of Fig. 29; and

Fig. 31 is a cam diagram illustrating the timing cycle of the automatically operated elements comprising the improvements disclosed herein.

Referring now, more particularly to Figs. 1, 2, and 4 of the drawings, the type of knitting machine illustrated is conventional and comprises a sub-base, generally identified by the numeral 1, fabricated from angle iron sections welded or otherwise secured together and providing a support for a main frame including a bedplate 2 and four supporting legs 3 extending downwardly from said bedplate and attached by bolts 4 to the top members of said sub-frame. A conventional column 5 has a flange at its lower end secured to the bedplate 2 by bolts 6 and a conventional pedestal bracket 7 is similarly mounted upon said bedplate. A platform 8 is secured to the bracket 7 by bolts 9 and is further supported in spaced relation to the bedplate 2 by a bracket 10 secured to said bedplate by bolts 11 (Fig. 1).

The bracket 7 carries the usual conventional driving mechanism well known to all those familiar with circular knitting machines. Therefore, for present purposes it will be unnecessary to describe such driving mechanism in detail other than to point out briefly that it includes the usual idle, slow and fast speed drive pulleys 12, 13, and 14 respectively, and the conventional reversing clutch 15 for effecting alternating and/or continuous rotary motion of the main drive bevel gear 16, and to point out that the main cam drum 17 is mounted upon a shaft 18 (Fig. 2) supported at one end by the bracket 10 and at its opposite end by the bracket 7, the shaft 18 having a gear 19 adjacent the cam drum 17 driven by a conventional gear train 20.

The cam drum 17 makes one revolution for each complete cycle of the machine and is provided with a number of special cams designed to control the automatic attachment of the tensioning weight to the stocking while it is being knitted, the automatic detachment of the tensioning weight from the stocking after knitting has been completed, and the subsequent automatic withdrawal of the completed stocking from the work tube, as will be explained more fully hereinafter.

Referring now, to Fig. 21, the main drive bevel gear 16 meshes with a bevel gear 27 disposed in a recess 28 in the platform 8. The gear 27 is retained in the recess 28 by a plate 29 secured to the platform 8 by machine screws 30. The gear 27 is drivingly inter-connected with a conventional needle cylinder 31, by a key 32. The needle cylinder 31 is provided with longitudinally extending grooves 33 in which the usual cylinder needles and jacks 34 are mounted. For present purposes, it will be unnecessary to describe in detail the usual stationary cams 35 and 36 which control the operation of the cylinder needles. A dial ring 38 is disposed adjacent the upper ends of the needles 34 and a latch ring 39 is shown in dot and dash lines above the needle dial.

The upper end of the needle cylinder 31 is recessed as indicated at 40 to receive a conventional ring 41 secured thereto by screws 42. A stocking-receiving or work tube 45 has its upper end extended into an elongated hub portion 46 of the bevel gear 27 and has a free running fit in said hub portion. An abutment ring 47 is secured by threads 48 to the upper end of the work tube 45 and is provided with an inwardly extending shoulder 49 for a purpose explained later. A sleeve 50 is disposed immediately above the ring 47 and is flared outwardly at its upper end 51 so that it partially overlies the ring 41. The sleeve 50 may be force-fitted or otherwise secured to the hub portion 46 of the gear 27 for effecting rotation thereof with the needle cylinder 31.

Referring now to Fig. 17, a core or end closure 52 is fastened to the lower end of the work tube 45 by a plurality of set screws 53. The lower end of the core 52 is shouldered as indicated at 54 to receive one race of a ball thrust bearing 55, the cooperating race of which is mounted in a bracket 56 secured by bolts 57 to a base plate 58 of the sub-frame 1. A gear 59 is secured to the end member 52 at a point between the lower end of the work tube 45 and the bracket 56, whereby the work tube 45 can be rotated or held stationary independently of the needle cylinder 31.

Referring now to Fig. 21, a spur gear 60 is secured to a flange depending from the bevel gear 27 by a plurality of screws 61, so that the gear 60 rotates at all times with the bevel gear 27. A gear 62 (see Figs. 1, 4, 5, and 7) of the same pitch diameter as the gear 60, is in constant mesh with the gear 60 and is fixed to a vertical shaft 63 disposed parallel with the work tube 45. The shaft 63 is rotatably journaled in a bracket 64 disposed adjacent the gear 62. The bracket 64 is maintained in fixed spaced relation to the platform 8 by hangers 65 bolted at 66 to said bracket and at 67 to said platform.

Referring now to Fig. 8, the lower end of the shaft 63 is supported by a thrust bearing 68 mounted in a bracket 69 secured to the plate 58 of the sub-base 1 by bolts 70. A gear 71 of the same pitch diameter as the gear 59 fixed to the lower end of the work tube 45 is loosely mounted upon the shaft 63 and meshes with the gear 59. One element 72 of a friction clutch, generally identified by the reference numeral 73, is secured to the gear 71 by screws 74. The clutch 73 comprises an element 75 which is fixed against rotation with respect to the shaft 63 by a pin 76. The clutch element 75 is bifurcated at its opposite ends for the reception of links 77 which are pivotally connected thereto by pins 78. Each of the links 77 carries an arcuate shoe 79 arranged to frictionally engage with the outer periphery of the friction member 72. The upper end of each of the links 77

is engaged by a conical cam **80** slidable on a sleeve **81** mounted on the shaft **63** above the clutch member **75**. The cone member **80** has a groove **83** formed therein for the reception of trunnions **84** carried by a yoke portion **85** of a clutch operating lever **86**, said lever being pivotally connected by a pin **87** (Figs. 1 and 7) to the upper end of a bracket **88**, suitably secured to an angle member of the sub-base **1**. A spring **89** has one end thereof connected to the lever **86** and its opposite end is connected at **90** to the base plate **58**. The spring **89** thus tends to continuously urge the cone **80** downwardly to actuate the links **77** to engage the sgements **79** with the friction member **72** to effect driving engagement between the clutch element **75** and the gear **71**.

As is best shown in Fig. 7, one end of a rod **91** extends through an opening **92** in the clutch operating lever **86** and collars **93** are fixed to said rod upon opposite sides of said lever to mechanically interconnect said rod and lever. The upper end of the rod **91** is connected to a laterally extending arm **94** of a lever **95** pivotally mounted upon the bracket **10** by a screw **96**. The lever **95** has a curved finger **97** formed integrally therewith which is adapted to be engaged at appropriate intervals by cams **98** and **99** mounted upon one end face of the main cam drum **17**. A spring **100** has one end thereof connected to the arm **94** and its other end connected to a bracket **101** carried by the bracket **10** and always tends to urge the finger **97** into engagement with the cams **98** and **99**. A second spring **100***a* may have one end connected to the lever **95** and its other end connected to a bracket **100***b* mounted upon the column **5**. A stop member **102** mounted upon the plafrom **8** limits clockwise movement of the lever **95** under the action of springs **100** and **100***a*.

With the parts in the position shown in Fig. 8, the clutch **73** would be engaged, but upon continued rotation of the cam drum **17** in a clockwise direction, the clutch **73** would soon be disengaged by virtue of the fact that the cam **98** would act upon the finger **97** and cause the lever **95** to rotate in a counterclockwise direction. Such rotation would effect raising of the lateral arm **94** of the lever **95** with a consequent raising of the rod **91** and cause the yoke **85** of the lever **86** to raise the cone **80** to thereby interrupt the frictional contact between the member **72** and the shoes **79** carried by the links **77**.

As has been previously explained, the clutch gear **71** is in constant mesh with the gear **59** carried by the work tube **45** so that, upon disengagement of the clutch **73**, the driving of the work tube **45** is interrupted. The work tube **45** is stopped in predetermined indexed relation by stop mechanism described hereinafter for purposes to be explained later.

Referring now to Fig. 17, the end member **52** of the work tube **45** has an axially extending passageway **105**, which is enlarged at its lower end and provided with threads **106**. A conventional air supply fitting **107** is threaded into engagement with the threads **106** and includes a plug **108** provided with a vertical passageway **109** communicating with passageway **105**, and a plurality of traverse ports **110** communicating with the passageway **109**. The plug **108** is secured to the member **52** for rotation therewith and a stationary fitting **111** surrounds the ports **110** and has one end of an air pressure supply pipe **112** connected thereto. The other end of the pipe **112** is connected by conventional pipe fittings **113** (Fig. 15) with the outlet opening **114** (Fig. 16) of a conventional three-way air valve **115**. The valve **115** has an inlet **116** to which is connected a pipe **117** communicating with a source of supply of air under pressure (not shown). The valve **115** has a rotatable core **118** provided with a diametrically extending port **119** and a port **120** extending laterally therefrom. The body of valve **115** is further provided with an exhaust port **121** which communicates at all times with the atmosphere. One end of an operating arm **122** is fixed to the valve core **118** for effecting rotation thereof. The opposite end of the arm **122** is pivotally connected by a pin **123** with the lower end of a rod **124**. The upper end of the rod **124** is connected by a pin **125** with a lever **126**. A block **127** is secured to a member **128** of the sub-base **1** by a bolt **129**. A pin **130** is mounted on the block **127** and serves as a fulcrum for the lever **126**. One end of a rod **131** is pivotally connected to the lever **126** by a pin **132** and the opposite end of said rod is connected by a pin **133** to the medial portion of an arm **134**. The arm **134** is mounted for free pivotal movement upon a stationary shaft **135** (Figs. 1 and 2) having one end thereof fixed in a bracket **136**, which in turn is mounted upon the bracket **10** by cap screws **137**. The shaft **135** is further supported by a bracket **137***a* secured to the pedestal bracket **7** and having bosses **138** and **139** for the reception of said shaft. The free end of the arm **134** (see Fig. 15) is adapted to be engaged by cams **140** and **141** mounted upon the outer periphery of the main drum **17**. One end of a tension spring **142** is connected to the lever **126** and the opposite end of said spring is connected to the lower end of a wire **143** (Figs. 1 and 2) having its upper end connected to a screw eye **144** mounted on the underside of the bedplate **2**.

It will be apparent from the arrangement of the spring **142**, as shown in Fig. 15, that it tends to urge the free end of the arm **134** downwardly toward the cam drum **17** at all times through is action upon the lever **126** and rod **131**. It will be equally apparent that when the arm **134** is engaged with the periphery of the drum **17**, the spring **142**, acting through the lever **126** and rod **124**, tends to maintain the arm **122** of the air valve **115** in a position such that atmospheric communication is established with the lower end of the work tube **45** through the exhaust port **121** in the valve body, the ports **119** and **120** in the valve core, and the pipe **113** which communicates with the interior of the work tube **45**.

The cams **140** and **141** are designed so that they will engage with and raise the free end of the arm **134** and cause it to rock about the shaft **135**. When the arm **134** is engaged by either cam **140** or **141** it will then actuate the rod **131**, lever **126**, rod **124** and valve arm **122** to cause the valve core **118** to rotate clockwise through an angle of 90 degrees from the position shown in Fig. 16 to thereby position the port **119** in a horizontal plane and establish communication between the inlet opening **116** and the outlet opening **114** of the air valve **115**. When the port **119** is so positioned, air under pressure will be admitted through the conventional fitting **107** and the passageway **105** into the lower end of the work tube **45**, for a purpose which will be described later.

A piston **145** (see Fig. 6) is slidably mounted in the work tube **45** and is free of all packing rings and other sealing devices, and is purposely fitted so as to provide a clearance of a few thousandths of an inch between its outer periphery and the inner surface of the work tube **45**. The purpose of this clearance is to permit the piston **145** to return to the lower end of the work tube **45**, by gravity, and with a dash-pot action, whenever the air pressure in the work tube **45** is released by opening of the air valve **115**. It may be mentioned, incidentally, that the internal diameter of the work tube **45** is two inches and that the piston **145** is fitted therein with an all-around clearance of .003 of an inch.

A tensioning weight or take-up device generally identified by the numeral **146** is disposed in the work tube **45** above the piston **145**. The tensioning device is illustrated in detail in Figs. 23 to 26, inclusive, to which particular reference will now be made.

The tensioning device **146** comprises a generally cylindrical body **147** having four flutes **148** formed in its outer periphery. A cylindrical bore **149** extends axially throughout the length of the body **147** and is provided for the reception of a rod **150** having a spherical cam **151** mounted upon its upper end. The rod **150** extends

through an opening 152 in a plate 153 which is secured to the lower end of the body 147 by screws 154. The rod 150 has a sliding fit in the opening 152 and the spherical cam 151 has a fairly close fit in the bore 149 so that the rod and cam are guided for vertical movement relative to the body 147. The lower end of the rod 152 is provided with threads 155 for the reception of nuts 156 and 157. A washer 158 is disposed between the nuts 156 and 157 and a compression spring 159 is disposed between the washer 158 and the plate 153. The action of the spring 159 is to constantly urge the cam 151 downward toward the plate 153. The force of the spring 159 can be varied by adjusting the position of the washer 158 along the threaded portion of the rod 150.

The body 147 has a diametrical slot 160 extending across its upper end and of a substantial depth. A vertical groove 161 extends downwardly from the slot 160 at diametrically opposite portions of the bore 149. A pair of gripping fingers 163 is pivotally mounted upon the body 147 by shouldered pins 164 having the threaded shank thereof received in a threaded opening 165 in the body 147. The portion of the confronting faces of each of the gripping fingers 163 disposed within the body 147 is provided with a generally V-shaped notch to form upwardly converging cam surfaces 166 and downwardly converging cam surfaces 167, the latter cam surfaces being formed upon a downwardly extending extension 168 of said fingers and disposed below the pivot pins 164. The fingers 163 are shaped so that they are inclined toward each other in an upward direction and each finger carries a rubber pad 169 preferably adhesively bonded thereto and adapted to engage with the welt portion of a stocking with sufficient pressure to suspend the tensioning weight assembly 146 from the stocking, as will appear more fully hereinafter.

The upper extremity of each of the fingers 163 is also especially shaped so that when said fingers are spread apart they will deflect the fabric being knitted into the space between the fingers until about four inches, or any other suitable length of fabric, has been knitted to enable said fingers to grip the same upon closure thereof. Thus, each finger 163 includes a hollow, laterally extending projection 170 having an outer portion 171 shaped so that it generally conforms to the inner surface of the upper end of the flared sleeve 50 and also having an angularly disposed portion 172 shaped to deflect the fabric inwardly of the finger.

It will be apparent from Fig. 24 that when the cam 151 is engaged with the cam surfaces 167 of the fingers 163, the spring 159 will urge the fingers 163 toward each other into clamping engagement with any fabric that may be disposed therebetween. On the other hand, and as will be apparent from Figs. 15, 21 and the cam diagram shown in Fig. 31, when the cam 141 is engaged with the arm 134 the air valve 115 will be opened to admit air under pressure into the work tube 45. The piston 145 will then be raised and carry the tensioning or take-up assembly 146 to the upper end of the work tube 45 until the body 147 is engaged with the shoulder 49 of the abutment ring 47. Continued upward movement of the piston 145 against the force of the spring 159 will then raise the rod 150 causing the cam 151 carried by said rod to engage the cam surfaces 166 of the fingers 163 disposed above the pivot pins 164 and spread said fingers apart with their upper ends in engagement with the inner surface of the sleeve 50. The tensioning device 146 is thus conditioned to receive the welt portion W of a stocking S between the fingers 163 thereof.

Upon release of the air pressure in the work tube 45, that is, when the arm 134 rides off the cam 141 and onto the drum 17 and the valve 115 is actuated to exhaust air from the work tube 45 the pressure on the piston 145 will be relieved and it will start to descend by gravity. The downward movement of the piston 145 will allow the spring 159 to force the cam 151 downwardly into engagement with the cam surface 167 on the fingers 163 below the pivot pins 164 and force them toward each other and into clamping engagement with the portion of the stocking disposed therebetween to thus suspend the tensioning weight 146 from the fabric while it is being knitted. The dash-pot action provided by the slight clearance between the piston 145 and the work tube 45 allows the piston to descend slowly and serves to prevent the piston from dropping suddenly in the work tube and striking the end member 52 with an objectionable thud.

The tensioning device 146 remains suspended from the stocking until knitting thereof has been completed, the tensioning device gradually being lowered in the work tube 45 as knitting of the stocking progresses. Assuming that the machine is knitting a woman's stocking, the tensioning device 146 will eventually descend to a region spaced a short distance above the fully descended piston 145 by the time that knitting of the stocking will have been completed, so that upon severing of the threads upon completion of the stocking, the tensioning device 146 will drop only a short distance.

Fig. 27 illustrates the position which the tensioning device 146 and stocking S assume after the tensioning device has dropped in the work tube into engagement with the piston 145. Before the completed stocking S can be withdrawn from the work tube 45, the tensioning device 146 must release the same. The release of the stocking is automatically effected by the cam 140 in conjunction with mechanism which will now be described.

Referring now to Figs. 6, 13, 14 and 28, the work tube 45 has a horizontal slot 175 extending through one side thereof and adapted to have a stop member 176 projected inwardly therethrough. The stop 176 is carried by a clamp 177 mounted upon the work tube 45 and comprising two generally arcuate sections 178 and 179, which surround the tube 45 and are secured together by cap screws 180, as best shown in Fig. 14. The section 179 has a recess 181 formed therein for the reception of the stop 176, and a bolt 182 extends through an opening 183 formed at the outer end of said recess, the stem of said bolt being threaded into said stop. A compression spring 184 is disposed between the section 179 and the head of the bolt 182 and constantly urges the stop 176 toward retracted position. A rubber gasket 185 is disposed between the clamp 177 and the work tube 45 and is apertured in the zone of the slot 175 to permit the passage of the stop 176 therethrough. The purpose of the gasket 185 is to prevent leakage of air under pressure from the work tube 45 at any time that the air valve 115 is open to admit air under pressure into the work tube 45.

Referring now to Figs. 11 and 13, in particular, a right-angle shaped support 186 is secured to the sub-base 1 by bolts 187 extending through frame members 188 and 189, respectively. A right-angle shaped lever 190 is pivotally mounted upon the bracket 186 by a fulcrum pin 191. The lever 190 includes an upright arm having a pad 192 secured to its upper end and adapted to engage with the head of the bolt 182. The pad 192 is normally maintained in retracted position by a tension spring 193 having one end thereof connected with a horizontal arm 194 of the lever 190, and its opposite end connected to a screw 195 mounted in the frame member 188. The lower end of a rod 196 is connected to the lever arm 194 by a pivot pin 197 at a point between the spring 193 and the pivot pin 191. The upper end of the rod 196 is connected by a pivot pin 198 to the intermediate portion of an arm 199, which is similar to the arm 134 and is disposed adjacent to said arm for free pivotal movement on the shaft 135. The arms 134 and 199 are disposed side by side and restrained against movement longitudinally of the shaft 135 by collars 200 and 201 (Fig. 2) secured to said shaft and disposed at the outer sides of said arms. A cam 202 (Fig. 13) for controlling the advance and retraction of the stop 176 is mounted upon the main drum 17 and is adapted to engage with the free end of the arm 199 to

rock said arm about the shaft **135**. It will be apparent that when the cam **202** raises the arm **199**, the rod **196** will cause the lever **190** to pivot about its fulcrum pin **191** and, through engagement of the pad **192** with the head of the bolt **182**, the stop **176** will be projected into the work tube **45** from its retracted position shown in Figs. 13 and 14 to its advanced position shown in Fig. 28.

It will be noted from Fig. 6 that the stop **176** is disposed in a region a short distance above the tensioning device **146** when said device is in its lowermost position. The time cycle of the machine, see Fig. 31, is such that after knitting of the stocking has been completed and the tensioning device **146** has dropped to the lower end of the work tube **45**, air under pressure is admitted into the work tube **45** by the air valve **115** under the control of the cam **140** (Fig. 15), so that the piston **145** is forced upwardly in the work tube **45** and bodily raises the tensioning device **146** until the upper end of the body **147** engages with the advanced stop **176**, as shown in Fig. 28. The stop **176** prevents further upward movement of the body **147**, but the piston **145** does move farther upwardly against the force of the spring **159** forcing the rod **150** upwardly with respect to the body **147** to engage the cam **151** with the cam surfaces **166** on the fingers **163** to thereby spread said fingers apart to their open position. The stocking S is then released from the fingers **163** so that it can be removed from the work tube **45** by the suction inducing means which will be described later.

In order for the stop **176** to be actuated by the lever **190**, it is necessary, of course, that the work tube **45** be held stationary in a predetermined indexed position such that the bolt **182** lies in front of the pad **192** carried by the lever **190**. In order to effect such indexing, a radial stop **205** (Figs. 7, 8 and 12) is welded to the under side of the gear **71** for interrupting rotation of said gear by the friction clutch **73** in a predetermined position. The gear **71** meshes with the gear **59** at the lower end of the work tube **45**, as previously stated, so that stopping the gear **71** in a given position necessarily results in the work tube **45** being stopped in a corresponding indexed position.

As shown in Fig. 12, the stop **205** is engaged in a notch **206** formed in an indexing arm **207**, which is pivotally secured by a cap screw **208** to a block **209**, the latter in turn being secured to a frame member **210** of the sub-base **1** by cap screws **211**. A similar indexing arm **212** is pivotally mounted upon the block **209** by a cap screw **213**. The arm **212** is provided with a notch **214**, also adapted to engage the stop **205** to index the gear **71** in a position displaced 180° from that shown in Fig. 12. The arms **207** and **212** are interconnected by a link **215** attached to the respective arms by pivot screws **216** and **217**. One end of a strong spring **218** is connected to the end of the link **215** at the front of the machine and the other end of said spring is connected to an upright frame member **219** of the sub-base **1**. A relatively lighter spring **220** has one end thereof connected with the arm **212** and its other end anchored to the base plate **58** by a bolt **220***a*. The relative strength of the springs **218** and **220** is such that the spring **218** normally tends to bias the arms **207** and **212** toward the front of the machine to the position shown in Fig. 12.

Referring now more particularly to Figs. 9, 10 and 12, one end of a rod **221** is connected by a pivot pin **222** to the arm **207** at a point between the pivot pins **208** and **216**. The opposite end of the rod **221** is pivotally connected at **223** to the lower end of a lever **224**. The upper end of the lever **224** is fixed to a shaft **225** rotatably mounted in a sleeve **226** fixed in a bracket **227** mounted upon a frame member **228** of the sub-base **1** by bolts **229**. A lever **230** is fixed to the other end of the shaft **225** and has one end of a rod **231** connected thereto by a pivot screw **232**. The upper end of the rod **231** (see Fig. 9) is connected by a pivot pin **233** to the intermediate portion of an arm **234** similar to the arms **134** and **199**. The arm **234** is also mounted for free pivotal movement upon the shaft **135** and is held against longitudinal movement along the shaft **135** by collars **235** and **236** (see Fig. 2) fixed to said shaft.

A low cam **237** (Fig. 9) and a relatively high cam **238** are secured to the main drum **17** for controlling the operations of the work tube indexing mechanism. The free end of the arm **234** is shown engaged with the outer periphery of the drum **17**. The arm **207** is engaged with the stop **205** on the gear **71**, when said stop extends toward the rear of the machine, as shown in Fig. 12, and thus effects indexing of the work tube **45** in a position such that the bolt **182** carrying the stop **176** is in a position to be engaged by the pad **192** on the lever **190**. The work tube **45** is then also properly indexed to permit subsequent removal of the completed stocking through an opening **250** therein (after the tensioning weight **146** has been detached from the stocking), as will be explained later. When the high cam **238** engages with the free end of the arm **234**, said arm will be raised and, through the rod **231** will cause the lever **230** to rock the shaft **225** with the result that the lever **224**, acting through the rod **221**, will cause the arms **207** and **212** to be swung toward the rear of the machine at the appropriate time in the cycle with the result that the stop **205** will engage with the notch **214** in the arm **212** to index the work tube in a position 180 degrees removed from that effected by engagement of the arm **207** with the stop **205**. The stop **205** then extends toward the front of the machine to properly index the work tube **45** so that the opening **250** is obstructed while the tensioning weight **146** is being attached to another stocking, as will be explained later. When the low cam **237** is engaged with the free end of the arm **234**, the indexing arms **207** and **212** are maintained in an intermediate or neutral position. That is to say, in a position in which gear **71** is free to rotate and drive the work tube **45** without having the stop **205** thereof engaged by either of the indexing arms **207** or **212**.

The work tube **45** has a running fit in a bracket **245**, see Figs. 1, 2, 4, 6, 18 and 19, secured to the underside of the bedplate **2** by cap screws **246**. The bracket **245** has a detachable section **247** secured thereto by cap screws **248**. The bracket section **247** has a horizontal nozzle **249** extending therefrom, and the work tube **45** has the outlet opening **250**, supra, adapted to be indexed with said nozzle, as shown in Fig. 18, to permit withdrawal of a stocking from the work tube **45** when the stop **205** is engaged by the indexing arm **207**. The inner edge of the opening **250** is preferably rounded and smooth to prevent snagging of the stocking during removal. The diameter of the opening **250** and the internal diameter of the nozzle **249** is 1½".

One end of a flexible conduit **251** is secured to the nozzle **249** by a conventional clamp **252**. The other end of the conduit **251** is attached to an inlet **253** (see Fig. 2) of a stocking container or receptacle **254** forming part of a suction creating or vacuum device V. The container **254** has a cover **255** in which is mounted a conventional motor **256** and a blower **257** for producing a suction in the conduit **251**. The receptacle **254** has a screen guard **258** suitably mounted therein at one side of the inlet opening **253** behind which stockings S withdrawn from the work tube **45** through the conduit **251** can collect without obstructing the opening **253**. The cover **255** is held in air-tight relation with the receptacle **254** by a plurality of latch members **259**. The cover **255** is, therefore, removable at intervals to enable manual removal of the stockings S accumulated in the container **254**.

The motor **256** is connected by electrical conductors **260** and **261** with a conventional switch **262** fixedly mounted upon a bracket **263** carried by a post **264** mounted upon the upper end of the pedestal bracket **7**.

Electrical current is supplied to the switch 262 through a conventional plug 265 adapted to be inserted into a conventional socket (not shown).

Any suitable suction creating device having a storage receptacle associated therewith may be used in connection with the work tube 45, and a "Lewyt" tank type vacuum cleaner with its hose attached to nozzle 249 and modified to include the screen guard 258 has actually been successfully employed to withdraw stockings from the work tube 45 for deposit in the receptacle 254.

Referring particularly to Fig. 20, the switch 262 has a button 266 adapted to be pushed inwardly to complete the circuit to the motor 256 of the vacuum device V. The switch button 266 is actuated at the appropriate time in the cycle by a suction control cam 267 mounted upon the cam drum 17. An arm 269 is mounted for free pivotal movement on the shaft 135 and a rod 272, having a lower offset end connected with the arm 269, carries an enlargement 273 at its upper end adapted to engage the switch button 266. The rod 272 is maintained in a substantially vertical position by a guide 274 secured to the bracket 137a by a cap screw 275. The free end of the arm 269 is adapted to be raised by the cam 267 and is illustrated in its raised position in Fig. 20. Such upward movement of the arm 262 correspondingly raises the rod 272 to force the switch button 266 inwardly to close the switch 262 and thus complete the circuit to the motor 256 of the suction device V. Thus, with the parts in the position illustrated in Fig. 20, the motor 256 would be in operation to create a suction in the conduit 251 and nozzle 249 for withdrawing a stocking from the work tube 45.

Figs. 18, 27 and 28 illustrate the opening 250 of the work tube 45 in the position it assumes relative to the nozzle 249 corresponding to the time that the stop 205 on the gear 71 is engaged by the indexing arm 207 to hold the work tube 45 in a position in which the bolt 182, which operates the stop 176, is indexed with the end 192 of the lever 190. Hence, when the cam 140, Fig. 15, engages the arm 134 to effect opening of the air control valve 115 to admit air under pressure into the work tube 45 to effect raising of the tensioning device 146 into engagement with the stop 176 to detach the same from the stocking S, as illustrated in Fig. 28, the opening 250 is disposed in registration with the nozzle 249. It will be noted from the cam diagram, Fig. 31, that the suction is on before the cam 140 opens the air valve 115 to effect detachment of the tensioning weight 146 from the stocking S. Hence, suction starts to pull the particular portion of the stocking S disposed in the plane of the opening 250 into the nozzle 249 before said stocking is released from the tensioning weight 146. It will also be noted that suction is effective before the stop 176 is projected into the work tube 45 and this feature prevents any possible catching of the stocking S on said stop by taking all slack out of the stocking between the tensioning weight 146 and the opening 250. Once the stocking S is free from the fingers 163 it is quickly withdrawn from the work tube 45 and deposited in the receptacle 254.

When the arm 234, Fig. 9, is engaged with the high cam 238, the notch 214 of the indexing arm 212 will be engaged with the stop 205 on the gear 71 and the work tube 45 will be held stationary with the opening 250 of said work tube disposed out of registration with the nozzle 249, as illustrated in Fig. 19. It will be noted from Fig. 19 that the opening 250 is offset 90° from the bolt 182, which carries the stop 176, and that the wall of the work tube 45 opposite the opening 250 obstructs communication between the interior of said work tube and the nozzle 249. Hence, when the cam 141 (Fig. 15) engages the arm 134 to actuate the valve 115 to admit air under pressure into the work tube 45 to raise the tensioning weight 146 to engage the shoulder 49, as illustrated in Fig. 21, no air can escape from the work tube 45 through the nozzle 249. Of course, some air will escape around the piston 145 through the clearance space surrounding said piston, but this is negligible and does not adversely affect the operation of the machine, particularly since an air pressure of 17 to 20 lbs. per square inch is normally employed to actuate said piston.

In the normal operating cycle of the machine, about eighteen courses of the welt W of a new stocking are knitted before the tensioning device 146 is raised to the upper end of the work tube 45 and its fingers 163 spread apart, as previously described. The work tube 45 is held stationary at this time by virtue of the fact that the indexing arm 212 is engaged with the stop 205 on the drive gear 71, the clutch 73, of course, being disengaged. As the needle cylinder 31 rotates, knitting continues, and the welt W feeds down into the space between the fingers 163, being so directed by the inclined surfaces 272 thereof. After a length of about four inches has been knitted, or preferably at the time that the stitches are being transferred from the dial back to the needles, the air pressure in the work tube 45 is released by actuation of the valve 115 to exhaust position under the control of cam 141, thereby allowing the piston 145 to slowly descend by gravity to the bottom of said work tube and permitting the fingers 163 to close into gripping engagement with the knitted portion of the stocking therebetween under the action of the spring 159. It will be understood that the air control cam 141 may be designed so that the air pressure may be released from the work tube 45 at any time, so long as there is a sufficient length of the knitted stocking (more or less than 4 inches) that can be gripped by the fingers 163. In any event, and as indicated by the cam diagram, Fig. 31, the work tube 45 is held stationary until about the time that the fingers 163 grip the stocking fabric.

When the fingers 163 first take hold, the body 147 of the tensioning weight 146 is in frictional contact with the shoulder 49 of the abutment ring 47 at the upper end of the work tube 45, and in order to prevent twisting of the stocking in the region thereof between said fingers and the knitting zone (to avoid possible damage to the stocking or pulling out of the same from between the fingers (163), the indexing linkage 207—215—212 is moved to its neutral position, thereby freeing the gear 71, so that when the clutch 73 is engaged the work tube 45 is driven and this causes the weight 146 to rotate with the work tube 45 at the same speed as the needle cylinder 31, the rotation of the work tube 45 commencing at substantially the same time that the weight 146 is attached to the stocking.

After the fingers 163 have fully closed, the entire take-up weight 146 hangs free and suspended in the work tube 45 and rotates with the stocking.

Although the tensioning weight or take-up device 146 moves freely away from the abutment ring 47 as knitting progresses, the rotation of the work tube 45 is nevertheless continued until the knitting of the stocking has been completed and the last stitch has been shed from the needles, whereupon the completed stocking drops down into said work tube; the take-up weight 146 dropping by gravity and striking the piston 145 at the bottom of said tube. Thereafter, the indexing mechanism 207—215—212 is actuated from its neutral position as the arm 234 rides off the low cam 237 and onto the drum 17 to position the notch 206 of the arm 207 to engage the stop 205 on the gear 71 and thereby interrupt rotation of the work tube 45 with the stop 176 indexed with the stop-actuating lever 190. The friction clutch 73 slips momentarily when the gear 71 is thus held, but is timely disengaged as the cam 98 (Fig. 7) engages the finger 97 of the lever 95 to effect raising of the clutch actuating cone 80 to disengage said clutch.

With the average length women's hose, the portion of the leg of the stocking S about 18" from the welt will be disposed opposite the discharge opening 250, which at this time is held indexed with the discharge nozzle 249,

as shown in Fig. 27. Of course, the particular part of the stocking opposite the opening **250** will vary with the length of stocking being knitted. The suction device V is turned on just before knitting of the stocking is completed, so that the suction tends to draw the stocking into the nozzle **249** before the stocking is released from the weight **146**, as indicated in Fig. 27. It will also be noted from the cam diagram, Fig. 31, that the suction device V is turned on very shortly after the rotation of the work tube **45** is interrupted. It will be recalled that the cam **267** (Fig. 20) controls the switch **262** connected with the vacuum motor **252** (Fig. 2), which creates a vacuum condition in the nozzle **249** for pulling the stocking S out of the work tube **45**.

About twelve courses after the suction device V has been turned on, the lever **190** is actuated by its control cam **202** to project the stop **176** into the work tube **45**. The air pressure control valve **115** is thereafter opened by the cam **141** to admit air under presure into the lower end of the work tube **45** to raise the piston **145** and engage the body portion **147** of the take-up device **146** with the stop **176** and to open the fingers **163** and release the stocking S so that the suction already acting on the stocking can pull it through the discharge nozzle **249** and deposit the same in the receptacle **254**, all as previously described. Thereafter, the air presure control valve **115** is opened to exhaust, and the suction device V is turned off at about the same time, due to the design of the cams **140** and **267**, respectively, controlling the operation thereof, as will be apparent from the cam diagram, Fig. 31. The exhaust of air pressure from the work tube **45** then permits the piston **145** and the take-up device **146** to return by gravity to the lower end of said work tube. The stop-operating lever **190** is then retracted by the spring **193**, as permitted by the cam **202**, so that the stop **176** is automatically returned by the spring **184** to a position where its inner end is clear of the inner wall of the work tube **45**. The suction device V is actually in operation for about twenty courses from the time it first goes on until it is turned off. About eight courses after that the air presure control valve **115** is again opened by its control cam **140** to introduce air under pressure into the work tube **45** to again raise the piston **145** and take-up device **146** to a position at the upper end of said work tube and to effect opening of the fingers **163** in preparation for attachment to another stocking. However, before the valve **115** is opened, the clutch **73** is engaged to rotate the work tube **45** from the position shown in Fig. 18, in which the opening **250** communicates with the nozzle **249**, to the position shown in Fig. 19, wherein the opening **250** is out of communication with said nozzle. Engagement of the clutch **73** occurs as the finger **97** (Fig. 7) rides off the cam **98** into the space between cams **98** and **99**. Engagement of the cam **99** with the finger **97**, of course, effects disengagement of the clutch **73**. The aforementioned engagement of the clutch is timed to occur during the interval that the indexing mechanism **207—215—212** is being shifted so that the arm **207** releases the stop **205** on the gear **71** and the arm **212** is moved into position to engage said stop, as will be readily understood from the cam diagram, Fig. 31. With the tensioning device elevated to the upper end of the work tube **45**, the machine is ready to repeat its cycle.

Figs. 29 and 30 illustrate a different type of tensioning weight or take-up device, generally identified by the numeral **280**, particularly adapted for use with a knitting machine having conventional attachments (not shown) for knitting an elastic thread into the welt of a stocking. The modified take-up device is relatively much simpler in construction than the take-up device **146** and comprises a cylindrical body **281** having an axial passageway **282** extending therethrough and a rod **283** slidably mounted in said passageway. The rod **283** has a circular plate or head **284** at its upper end and threads **285** at its lower end. The body **281** is provided with a plurality of threaded openings in each of which is mounted a vertical finger **286**. Four fingers **286** are illustrated in the drawings, but it will be understood that any suitable number, either more or less than four may be used, if desired. A compression spring **287** surrounds the threaded portion **285** of the rod **283** and one end thereof is engaged in a recess formed in the lower face of the body **281** and the opposite end thereof is received in a cup washer **288**. Nuts **289** are mounted upon the rod **283** on opposite sides of the washer **288** and these are adjustable for varying the force of the spring **287** acting upon the rod **283** and tending to pull the plate **284** downwardly into engagement with the upper end of the fingers **286**. Additional nuts **290** are mounted upon the rod **283** and are adjustable to limit the extent of movement of the plate **284** in a direction away from the adjacent ends of the fingers **286**.

The cycle of operation of a knitting machine embodying the take-up device **280** is the same as that described in connection with the take-up device **146**. Thus, the take-up device **280** would be raised to the upper end of the work tube **45** by the piston **145** until the upper end of the body **281** engages with the shoulder **49** of the abutment ring **47**. Continued pressure of the piston **145** on the lower end of the rod **283** would then raise the plate **284** above the ends of the fingers **286** a predetermined distance as permitted by the position of the nuts **290**. Thus, a space X would be provided between the head or plate **284** and the fingers **286** to receive therein the welt W' of the stocking having the elastic thread knitted therein.

As is well understood in the knitting art, the welt end of an elastic-top stocking contracts as it is knitted, and such knitted portion will inherently contract into the space X between the plate **284** and the fingers **286**. After sufficient fabric has been knitted to contract the opening therein to a diameter smaller than the distance between the rod **283** and the fingers **286**, the air pressure on the piston **145** is released by actuation of the valve **115** to exhaust position and the plate **284** is permitted to move downwardly by the action of the spring **287**, with the result that the fabric is tightly clamped between said plate and the upper ends of said fingers. The clamping pressure exerted by the spring **287** is sufficient to suspend the entire tensioning or take-up weight assembly **280** from the knitted welt portion of the stocking. If desired, the undersurface of the plate **284**, or the upper ends of the fingers **286**, or both, may be knurled or provided with friction pads (not shown) to afford a better gripping engagement with the fabric. The takeup assembly **280** will move downwardly in the work tube **45** as knitting progresses, in the same manner as described in connection with the take-up device **146**. Thus, the tensioning weight will apply a uniform tension to the fabric during knitting thereof to produce uniform stitches.

It will be understood that the take-up device **280** will drop to the lower end of the work tube **45** upon completion of the knitting of the stocking and that release of the stocking will be effected through reactuation of the piston **145** to cause engagement of the body **281** with the stop **176** in the same manner as in effecting detachment of the weight **146**, and the action of the piston will raise the rod **283** while the body **281** is held against vertical movement, to effect a release of the stocking from between the plate **284** and the fingers **286**. Shortly therebefore, the cam **267** will effect actuation of the switch **262** and close the circuit to the motor **256**, whereupon suction created by the blower **257** will be adequate to pull the welt W' of the stocking off the plate **284** and withdraw the stocking from the work tube **45** in the manner previously described. Thereafter, the piston **145** and tensioning weight **280** are permitted to return to the lower end of the work tube **45**, the stop **176** is retracted meanwhile, and said piston and weight are again raised to

the upper end of said work tube and the machine is then ready to repeat its cycle of operation.

It will be understood that various changes may be made in the details of construction of the tensioning weights **146** and **286**, and in the construction and arrangement of the parts described herein for automatically controlling the operation thereof and the withdrawal of the stocking from the work tube **45**, without departing from the principles of the invention and the scope of the annexed claims.

I claim:

1. A take-up device; comprising: a body having an axial opening extending therethrough; a rod slidably mounted in said opening, said rod having a clamping member at the upper end thereof; a plurality of fingers mounted upon said body and disposed between said body and said clamping member; and spring means normally effective upon the opposite end of said rod for urging said clamping member toward the adjacent ends of said fingers.

2. In a knitting machine, an upright work tube open at its upper end and closed at its lower end; abutment means at the upper end of said work tube; a take-up device movable up and down in said work tube; a piston in said work tube disposed between said take-up device and said lower end of said work tube, said take-up device including fingers arranged and constructed to be operable by said piston when said take-up device is engaged with said abutment for spreading said fingers apart; and means for introducing air under pressure into said lower end of said work tube to actuate said piston to raise said take-up device into engagement with said abutment and spread said fingers apart.

3. A knitting machine as defined in claim 2, in which a second abutment is arranged to be projected into said work tube and to be engaged by said take-up device upon reactuation of said piston for spreading said fingers apart to release a stocking clamped between said fingers.

4. In a knitting machine, an upright work tube open at its upper end and closed at its lower end; a first abutment means at the upper end of said work tube; a second abutment means projectable into said work tube at a region intermediate the ends of said work tube; a take-up device moveable up and down in a said work tube; a piston in said work tube disposed between said take-up device and said lower end of said work tube, said take-up device including fingers arranged and constructed to be operable by said piston when said take-up device is engaged with either of said abutments for spreading said fingers apart; means for projecting said second abutment means into said work tube subsequent to engagement of said take-up device with said first abutment means; and means for introducing air under pressure into said lower end of said work tube to successively raise said take-up device into engagement with said abutments.

5. A knitting machine as defined in claim 4, in which the work tube has an opening formed therein at a point between the two abutment means, and in which means is provided for producing a suction at said opening.

6. In a knitting machine having instrumentalities for knitting a stocking, a work tube positioned to receive the knitted stocking, said work tube having a discharge opening formed therein; means for creating a suction at said discharge opening for withdrawing said stocking from said work tube through said discharge opening; and a container between said discharge opening and said suction creating means for storing successively removed stockings, said container providing a barrier for arresting said stockings.

7. In a circular stocking knitting machine, an upright tube for receiving the stocking fabric as it is knitted; a take-up device slidably mounted in said tube and operable to engage with and be attached to said stocking; a piston in said work tube below said take-up device; conduit means for admitting air under pressure into said work tube for raising said piston into engagement with said take-up device; an air valve connected in said conduit for controlling the admission and exhaust of air under pressure into and from said work tube; a cam controlling the operation of said air valve; and means controlled by said cam for effecting opening and closing of said air valve.

8. In a circular stocking knitting machine, an upright tube for receiving the stocking fabric as it is knitted; means for automatically attaching a tensioning weight to said stocking while it is being knitted and for automatically detaching said tensioning weight from said stocking after knitting thereof has been completed; means for withdrawing the completed stocking from said work tube after said tensioning weight has been detached therefrom, said last-mentioned means comprising a drum having a cam mounted thereon, a motor driven suction producing device connected with said work tube for pulling said stocking out of said work tube, and a switch actuated by said cam controlling the operation of said motor.

9. In a circular stocking knitting machine, a work-receiving tube having an opening extending therethrough at a region intermediate its ends; a member having a discharge nozzle lying in the same horizontal plane as said opening in said work tube; means for holding said work tube stationary with the opening therein indexed with the discharge nozzle; and means for creating a suction in said discharge nozzle while said opening is indexed therewith to effect withdrawal of a completed stocking from said work tube.

10. In a circular knitting machine having a needle cylinder and gearing for driving said needle cylinder, a work tube: means for driving said work tube at the same speed as the needle, said drive means comprising a shaft, and a drive gear loosely mounted upon said shaft and meshing with a driven gear fixed to said work tube, said drive gear having a stop secured thereto; indexing mechanism including arms disposed on diametrically opposite sides of said drive gear and individually engageable with said stop to index said work tube in positions 180° apart; a friction clutch operative to drive said drive gear; and means for actuating said indexing mechanism and said friction clutch in relatively timed relation.

11. In a knitting machine having a needle cylinder and needles for knitting a stocking; means for driving said needle cylinder; a work tube having its upper end extending into said needle cylinder; a bevel gear surrounding said work tube and fixed to said needle cylinder; a spur gear fixed to said bevel gear; a shaft disposed substantially parallel with said work tube; a second spur gear fixed to said shaft and meshing with said first-mentioned spur gear; a third spur gear rotatably mounted upon said shaft; a clutch for drivingly interconnecting said shaft and said third spur gear; a fourth spur gear fixed relative to said work tube and meshing with said third gear; a drum; a clutch control cam on said drum; and means actuated by said cam, in time relation to the operation of said driving mechanism for said needle cylinder, controlling the operation of said clutch to engage with said third mentioned gear for drivingly interconnecting said shaft and work tube.

12. In a knitting machine having a needle cylinder and instrumentalities for knitting a stocking, a work tube having its upper end extending into said needle cylinder; an abutment member mounted upon the upper end of said work tube; a take-up device in said work tube including spring-pressed gripping means for attaching said take-up device to one end of said stocking during knitting; pneumatically operated means in said work tube for actuating said take-up device to effect attachment thereof to said stocking, said take-up device being adapted to return by gravity to the lower end of said work tube upon completion of the knitting of said stocking; a second abutment disposed intermediate the ends of said work tube and adapted to be projected into said work tube; means operable in time relation to the completion of the knitting of

said stocking for projecting said second abutment into said work tube; and means for again actuating said pneumatically operated means for engaging said take-up device with said second abutment to effect release of the knitted stocking.

13. In a knitting machine having a needle cylinder and instrumentalities for knitting a stocking, a work tube having its upper end extending into said needle cylinder; a tensioning device in said work tube attachable to the stocking fabric; pneumatically operated means for effecting attachment of said tensioning means to the stocking fabric while said stocking is being knitted, and for detaching said tensioning means from said stocking upon completion of knitting thereof; a bracket supporting said work tube for rotation relative thereto, said work tube having an opening formed therein and said bracket having a discharge nozzle in the same plane as said opening; means for indexing said work tube with said opening out of registration with said discharge nozzle while said pneumatically operated means is operative to attach said tensioning means to said stocking; means for indexing said opening with said discharge nozzle while said pneumatically operated means is operative to detach said tensioning means from said stocking; and means for creating a suction in said discharge nozzle for withdrawing the released stocking from said work tube through said opening while said opening and nozzle are indexed.

14. An automatic article tensioning device for a circular knitting machine having a needle cylinder and adapted to knit separate articles each of which is pressed off when completed, comprising vertically movable article grasping means, and power operated means for raising said article grasping means, for causing it to grasp the initial portion of an article while the article is being knit, and for thereafter effecting its downward movement while it grasps the article to impart tension to the article during knitting thereof, said power operated means comprising a cylinder and a pneumatically operated piston therein.

15. In a circular knitting machine having a needle cylinder and adapted to knit separate articles each of which is pressed off when completed, pneumatically operated means for automatically seizing the free end portion of each article while it is being knit and for imparting tension thereto during subsequent knitting, means for automatically releasing the completed article from said seizing means, and suction-producing means for removing the article from the vicinity of the seizing means.

16. In a circular knitting machine having a needle cylinder and adapted to knit separate articles each of which is pressed off when completed, pneumatically operated means for automatically seizing the free end portion of each article while it is being knit and for imparting tension thereto during subsequent knitting, and means for automatically releasing the completed article from seizing means.

17. In a rotary circular knitting machine adapted to knit separate articles each of which is pressed off when completed, means for seizing the free end portion of each article and for imparting tension thereto during knitting, said means comprising a plurality of fingers movable towards and from each other to clamp the article and shaped to direct the article into the space between the fingers by reason of relative rotary engaging movement between the article and the fingers.

18. In a rotary circular knitting machine adapted to knit separate articles each of which is pressed off when completed, means for seizing the free end portion of each article and for imparting tension thereto during knitting, said means being shaped to direct the artcile into position for seizure by reason of relative rotary engaging movement between the article and said means.

19. In a rotary circular knitting machine adapted to knit separate stockings beginning with the formation of turned welts thereof and adapted to press off completed stockings, means for seizing the welt of each stocking and for imparting tension thereto during knitting, said means being shaped to direct the welt during its formation into position for seizure by reason of relative rotary engaging movement between the fabric of the welt and said means.

20. In a rotary circular knitting machine adapted to knit separate stockings beginning with the formation of turned welts thereof and adapted to press off completed stockings, means for seizing the welt of each stocking and for imparting tension thereto during knitting, said means comprising a plurality of fingers movable towards and from each other to clamp the welt and shaped to direct the welt during its formation into the space between the fingers by reason of relative rotary engaging movement between the fabric of the welt and said fingers.

21. In a rotary circular knitting machine adapted to knit separate stockings beginning with the formation of turned welts thereof and adapted to press off completed stockings, means for seizing the welt of each stocking and for imparting tension thereto during knitting, said means comprising a plurality of fingers movable towards and from each other to clamp the welt and shaped to direct the welt during its formation into the space between the fingers by reason of relative rotary engaging movement between the fabric of the welt and said fingers, said machine providing a restricted region adjacent to the fingers for the reception of the welt durnig its formation, thereby to increase the force of engagement of the fabric of the welt with said fingers.

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